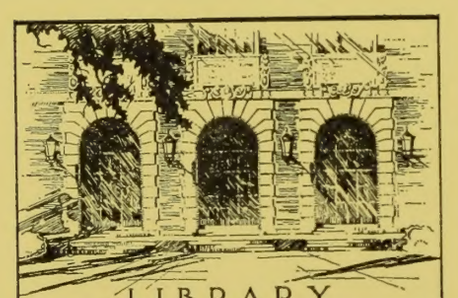

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SELECTED WATER RESOURCES ABSTRACTS

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VOLUME 2, NUMBER 17
SEPTEMBER 1, 1969

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

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VOLUME 2, NUMBER 17
SEPTEMBER 1, 1969

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Use of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States--now and in the future.

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FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

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To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Non-Water Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION
Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

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07 RESOURCES DATA
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08 ENGINEERING WORKS
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09 MANPOWER, GRANTS, AND FACILITIES
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SELECTED WATER RESOURCES ABSTRACTS

02. WATER CYCLE

2A. General

DETERMINATION OF HYDROGEOLOGICAL PARAMETERS UNDER THE CONDITIONS OF MUTUAL INTERACTION OF WATER-BEARING HORIZONS (RUSSIAN),
Moscow State Univ. (USSR). Hydrogeological Section.
For primary bibliographic entry see Field 02F.
W69-07094

THE DEVELOPMENT OF A MODEL TO EVALUATE HYDROLOGIC RISK IN A WATER RESOURCES SYSTEM,
Battelle Memorial Inst., Richland, Wash., and Texas A and M Univ., College Station.
For primary bibliographic entry see Field 06A.
W69-07100

2B. Precipitation

LEGAL STRUCTURES FOR INTERNATIONAL SUPERVISION OF WEATHER MODIFICATION TECHNIQUES,
For primary bibliographic entry see Field 06E.
W69-06916

STUDIES OF THE WINTER AND SUMMER MONSOONS IN EAST ASIA BASED ON DYNAMIC CONCEPT,
Japan Meteorological Agency (Tokyo).
Atsushi Kurashima.
The Geophys Mag, Vol 34, No 2, pp 145-235, Dec 1968. 91 p, 69 fig, 23 tab, 96 ref.

Descriptors: *Monsoons, *Dynamics, *Seasonal, *Summer, *Winter, Pressure, Air circulation, Tropical regions, Snowfall, Air masses, Rainfall, Anticyclones, Forecasting, Sea level, Frequency, Cyclones.
Identifiers: *East Asia monsoons, Winter monsoons, Summer monsoons.

The author presents a model indicating the synoptic process of the 'outbreak' of a northwestern monsoon in East Asia and shows that various flow patterns of winter monsoons in the neighborhood of Japan correspond to the respective long-wave patterns in upper westerlies. Characteristic parameters of the monsoons in North America and East Asia are discussed. The study indicates the presence of two stages in development of summer monsoons as a result of geographical and climatic conditions. (Gabriel-USGS)
W69-06977

SEASONAL VARIATIONS OF RAINFALL INTENSITIES IN VICTORIA,
Water Research Foundation (Australia).
A. Karoly.
Water Res Found of Australia Bull No 14, 1963. 55 p, 26 fig, 5 tab.

Descriptors: *Rainfall intensity, *Precipitation (Atmospheric), *Seasonal, Mathematical studies, Statistical methods, Summer, Winter, Spring, Autumn, Hydrologic data, Duration curves, Cities.
Identifiers: *Australian rainfall intensity, Victoria.

Using Melbourne rainfall for selected duration and the daily rainfall of 50 country stations, charts have been prepared giving the rainfall intensities for each of the four seasons for a return period of one year. To obtain intensities for other return periods, the one year intensity is multiplied by a frequency factor obtained from charts giving a function of the standard deviation of the logarithms (s) for the required duration (t) and return period (T). (Gabriel-USGS)
W69-07014

THE RAINS OF AUGUST AND SEPTEMBER 1968 IN THE FRENCH ALPS (FRENCH),
Center of National Scientific Research (France).
M. F. De Saintignon, and H. Vivian.
Rev de Geogr Alpine, Grenoble, Vol 57, No 2, pp 335-360, 1969. 26 p, 3 fig, 8 plate, 2 tab.

Descriptors: *Rain, *Precipitation (Atmospheric), *Seasonal, *Autumn, Winter, Winds, Meteorological data, Air temperature, Anticyclones, Climates, Climatic zones, Maps, Frequency, Mathematical studies, Statistical methods.
Identifiers: *French Alps.

A detailed analysis of rain characteristics in the French Alps was made on the basis of precipitation data recorded at many hydrologic gaging stations for the years of 1921 to 1965, 1931-1965, and 1936 to 1965. The study shows that by comparison with the hydrologic data recorded prior to 1966, the rains of August and September of 1968 were of the highest intensity in the greater part of the Northern Alps area. The statistical analysis also shows that these rains of 1968 intensity do nor occur more than 5 to 10 times in a century. (Gabriel-USGS)
W69-07123

2D. Evaporation and Transpiration

QUANTITATIVE MODEL OF MOISTURE FLOW IN THE PLANT-SOIL SYSTEM,
Hydrometeorological Service of the USSR (Moscow).
For primary bibliographic entry see Field 02G.
W69-06986

AN EXPERIMENTAL STUDY OF EVAPORATION FROM UNIFORM SOIL COLUMNS IN THE PRESENCE OF A WATER TABLE,
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agriculture Research.
A. Hadas, and D. Hillel.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 67-74, 1968. 8 p, 3 fig, 1 tab, 13 ref.

Descriptors: *Evaporation, *Soil water movement, Water table, Water levels, Drying, Hysteresis, Salinity, Saline soils, Soil physical properties, Soil chemical properties, Permeability.
Identifiers: Potential evaporativity.

The results of laboratory experiments on evaporation from uniform profiles in the presence of a water-table are presented. Theoretical solutions describing steady-state evaporation predict that when external evaporativity is increased the soil eventually attains a maximal evaporation rate which depends upon water-table depth and profile transmissivity and which remains constant regardless of how high external evaporativity may become. Experiments showed that instead of levelling off at the maximal evaporation rate, as evaporativity was further increased the actual evaporation rates began to decrease. This may result from gradual salt accumulation, structural effects or changes in boundary conditions (i.e. the formation of a two-layer condition in which a dry surface layer eventually acts as a diffusion barrier). A comparison of the measured evaporation rates and those predicted theoretically showed that both Gardner's and Anat's theories overestimated the maximal rate, especially for shallow water-table conditions. Modification of Gardner's theory to correct for excessively high conductivity values near saturation improved the estimate somewhat. Cyclic changes in evaporativity or in water-table depth apparently induced hysteretic effects which decreased the evaporation rate.
W69-06987

RELATION OF WATER APPLICATION TO EVAPORATION AND STORAGE OF SOIL WATER,
Agricultural Research Service, Fort Collins, Colo. Soil and Water Conservation Research Div.; and Agricultural Research Service, Riverside, Calif. Soil and Water Conservation Research Div.
H. R. Gardner, and W. R. Gardner.
Soil Sci Soc Amer Proc, Vol 33, No 2, pp 192-196, Mar-Apr 1969. 5 p, 8 fig, 1 tab, 7 ref.

Descriptors: *Evaporation, *Soil water, Irrigation, Infiltration, Rainfall, Infiltrometers, Evaporators, Soil water movement, Drying, Soils, Water balance, Humidity, Water loss, Diffusion, Temperature.
Identifiers: Soil water evaporation.

Evaporation was measured from columns of Rago loam and McGrew loamy sand, to which water had been added at several rates ranging from 0.25 cm/day to 10.2 cm every 20 days. The water lost by evaporation varied from 100% of the total applied for the smallest and most frequent addition to 31.2% for the 10.2 cm of water added to McGrew soil every 20 days. The losses from repeated cycles of the individual treatments tended to approach a constant value that was less than the potential loss. As the amount added was increased for a given evaporation period, the loss tended to approach a constant value that also was much less than the potential loss. The cumulative evaporation curves were scaled to dimensionless variables and compared with a theoretical solution of the diffusivity equation for finite media. Using this scaling-comparison technique, the losses from soil with two different potential evaporations were compared with predicted curves.
W69-07089

EVAPORATION FROM BARE SOIL UNDER HIGH RADIATION CONDITIONS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research and Regional Survey.
C. W. Rose.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 57-66, 1968. 10 p, 4 fig, 1 tab, 12 ref.

Descriptors: *Evaporation, *Soil water, *Soil water movement, Water temperature, Air temperature, Irrigation, Energy budget, Heat budget, Solar radiation, Mass transfer, Vapor pressure.
Identifiers: Evaporation from bare soil.

A theory is proposed enabling evaporation from bare soil to be calculated from measured water content and temperature profiles, provided relevant physical soil properties are determined. The theory is of general application and equates evaporation over any time period to the sum of upward liquid and vapor phase water fluxed at any depth in the soil and the decrease in water stored in the soil to that depth over the same interval. The theory is applied to data from an experiment in which profiles of water content and temperature were measured for a period of 6 days and nights following watering of bare soil by sprinkler irrigation. The mean daily shortwave radiation flux during the experiment was 617 cal/sq cm, and maximum soil temperature gradients approached 10 deg/C cm. Reasons for the somewhat complicated pattern of calculated evaporation rate are discussed, and it is shown that vapor phase transport of water is important under the conditions of this experiment. The mean ratio of evaporation by night to that of the preceding day was 0.6. One reason for this ratio being so high was the directional opposition between vapor and liquid fluxes by day and their concurrence at night. Possible errors in the calculated evaporation are considered.
W69-07135

2E. Streamflow and Runoff

FLOOD STAGES AND DISCHARGES FOR SMALL STREAMS IN TEXAS, 1967 WATER YEAR,
Geological Survey, Austin, Tex.
E. E. Schroeder.
Geol Surv Open-file Rep No 113, Mar 1969. 282 p, 2 fig, 4 tab, 6 ref.

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Descriptors: *Data collections, *Hydrologic data, *Floods, *Texas, Rainfall-runoff relationships, Discharge (Water), Stage-discharge relations, Streamflow, Small watersheds, Flow measurement, Gaging stations.
Identifiers: Flood measurements (Tex).

Flood stage and discharge data for small streams in Texas in the water year 1967 are compiled. Important floods are listed. Rainfall and inflow for significant storms at a San Antonio pumping station, and runoff and rainfall data for significant storms at 151 regularly operated gaging stations are tabulated. (Knapp-USGS)
W69-06946

WATER RESOURCES OF ANTELOPE COUNTY, NEBRASKA,
Geological Survey, Washington, D. C.
V. L. Souders, and F. B. Shaffer.
Geol Surv Hydrol Invest Atlas HA-316, 3 sheets, 1969. 18 fig, 4 map, 2 photo, 2 tab.

Descriptors: *Water resources, *Surface waters, *Groundwater, *Nebraska, Water wells, Water yield, Water quality, Transmissivity, Streamflow, Hydrographs, Duration curves, Floods, Runoff, Irrigation water, Aquifers, Alluvium.
Identifiers: *Antelope County (Neb).

The water resources of Antelope County, Nebraska are discussed in a 3-sheet hydrological Atlas consisting of maps, charts, diagrams, geologic cross sections, tables, photographs, and text. Most available water in the county is in the Ogallala aquifer of Tertiary age, consisting of alluvial material, silts, and clays. Well yields of as much as 2,000 gpm are possible in much of the county, and conditions are favorable for irrigation. Water levels have not been affected to an important extent by present pumping rates. All water in the county is of excellent quality for irrigation, and except for hardness it is suitable for all other uses. (Knapp-USGS)
W69-06976

ANALYSIS OF EMPIRICAL FORMULAS FOR THE DETERMINATION OF MAXIMUM RUNOFFS FROM SMALL MOUNTAIN BASINS (POLISH),
State Inst. of Hydrology and Meteorology, Warsaw, (Poland).
Janusz Walkowicz.
Arch Hydrotech, Vol 15, No 4, Warsaw, pp 515-553, 1968. 9 fig, 23 tab, 70 ref.

Descriptors: *Mathematical studies, *Analytical techniques, *Runoff, *High water mark, *Small watersheds, Frequency, Precipitation (Atmospheric), Slopes, Flow measurement, River basins, Altitude, Sea level.
Identifiers: *Poland, Small basin runoff, Empirical formula analysis.

This investigation develops new formulas for the determination of maximum runoffs of various frequencies from small mountain basins of 1 to 100 sq km area, at altitudes over 500 m. Stream courses vary in length from 1 to 25 km, annual precipitation varies from 700 to 1500 mm, and values for the mean water-course slope range from 0.021 to 0.1. These new formulas were developed on the basis of the analysis of the formulas pertaining to the evaluation of maximum annual discharges commonly used in Poland and abroad. The formulas developed by the author were applied to the hydrological data recorded at the gaging stations on the Bober River (Poland) and the Vistula River and gave satisfactory results. (Gabriel-USGS)
W69-07010

WATER RESOURCES OF THE MISSISSIPPI HEADWATERS WATERSHED, NORTH-CENTRAL MINNESOTA,
Geological Survey, Washington, D. C.
E. L. Oakes, and L. E. Bidwell.
Geol Surv Hydrol Invest Atlas, HA-278, 4 sheets, 1968. Test, 37 fig, 4 map, 8 tab, 8 ref.

Descriptors: *Water resources, *Groundwater, *Surface waters, *Minnesota, Mississippi River, Streamflow, Water yield, Runoff, Evaporation, Water quality, Hardness (Water), Recreation, Fishing, Floods, Duration curves, Hydrographs, Hydrologic data, Aquifers, Water wells.
Identifiers: Mississippi Headwaters Watershed (Minn).

The water resources of the Mississippi Headwaters watershed, Minnesota, are discussed in a 4-sheet Hydrologic Atlas consisting of maps, charts, diagrams, tables, and text. The groundwater reservoir contains the largest quantity of water available in the area. Well yields of as much as 500 gpm are possible in most of the area. The best aquifers are buried outwash deposits. Saturated thicknesses range from less than 50 ft to over 500 ft. Water hardness ranges from 68 to 700 mg/1, and all groundwater in the area is suitable for irrigation. Surface water is abundant and not subject to large variations in flow. Average runoff is about 5.3 inches. Evaporation is about 27 inches. Facilities for year-round water-based recreation are excellent. (Knapp-USGS)
W69-07012

FLOOD PLAIN INFORMATION STUDY, JACKSON, TENNESSEE.
Corps of Engineers, Memphis, Tenn.
For primary bibliographic entry see Field 04A.
W69-07013

SIPHON METHOD FOR MEASURING WATER LEVELS,
Geological Survey, Phoenix, Ariz. Water Resources Div.; and Agricultural Research Service, Chickasha, Okla. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 07B.
W69-07086

WATER RESOURCES OF MEXICO,
Mexico National Univ, Mexico City. Instituto de Geofisica.
Rodolfo C. del Arenal.
Water Resources Bull, Vol 5, No 1, pp 19-38, Mar 1969. 20 p, 9 fig, 3 tab, 14 ref.

Descriptors: *Water resources, *Water resources development, *Surveys, Water utilization, Water supply, Precipitation (Atmospheric), Water demand, Population, Climates, Water management (Applied), Water policy.
Identifiers: *Mexico, Water resources distribution.

A general review of Mexico's water resources is presented. In Mexico, the areas of greatest water demand are generally semiarid to arid, while in areas of abundant water, population and demand are low. Irrigation is required for profitable agriculture in nearly one-half the area of the country. Water availability and water demand are shown by maps. Water availability, population densities, and storage-dam data are tabulated. Present and suggested water policies are briefly discussed. (Knapp-USGS)
W69-07098

FLOOD PLAIN INFORMATION, LAGUNA CANYON, ORANGE COUNTY, CALIFORNIA.
Corps of Engineers, Los Angeles, Calif.
For primary bibliographic entry see Field 04A.
W69-07106

FLOOD PLAIN INFORMATION, CAGUITAS RIVER, CAGUAS, PUERTO RICO.
Corps of Engineers, Jacksonville, Fla.
For primary bibliographic entry see Field 04A.
W69-07107

FLOOD PLAIN INFORMATION, OUACHITA RIVER, ARKADELPHIA, ARKANSAS.
Corps of Engineers, Vicksburg, Miss.
For primary bibliographic entry see Field 04A.
W69-07108

INVESTIGATION OF THE EFFECTS OF CHANNEL GEOMETRY AND SURFACE VELOCITY ON THE REAERATION RATE COEFFICIENT,
New Mexico State Univ., University Park. Dept. of Sanitary Engineering; and Shell Oil Co., Bakersfield, Calif.
For primary bibliographic entry see Field 05G.
W69-07116

GENERAL CHARACTERISTICS OF VENEZUELAN RIVERS (FRENCH),
Instituto de Geografia y Conservacion de Recursos Naturales, Merida (Venezuela).
Pierre Perrin.
Rev de Geogr Alpine, Grenoble, Vol 57, No 2, pp 387-404, 1969. 18 p, 6 fig, 8 ref.

Descriptors: *Rivers, *Hydrologic properties, *Topography, Precipitation (Atmospheric), Discharge (Water), High water mark, Low water mark, River basins, Water level fluctuations, Snowfall, Winds, Floods, Seasonal, Anticyclones, Streamflow, Gaging stations.
Identifiers: *Venezuelian river characteristics.

General characteristics of Venezuelian rivers were analyzed on the basis of hydrogeological and geographical data recorded at gaging stations located in the river basins of Venezuela. The analysis shows that the Venezuelian rivers are strongly affected by tropical rains and topographic relief which determines atmospheric circulation. The results of this topographical relief are that the greater river discharges are associated with the rivers issuing from the Andes mountains and Guiana with their river courses passing through very populated areas of desert character. Under these unfavorable climatic conditions often associated with the effects of anticyclones, a problem of sufficient water supply for domestic and industrial use is of foremost importance and is difficult to resolve. (Gabriel-USGS)
W69-07124

FLOOD PLAIN INFORMATION, FEATHER RIVER, NICOLAUS, CALIFORNIA.
Corps of Engineers, Sacramento, Calif.
For primary bibliographic entry see Field 04A.
W69-07127

2F. Groundwater

GEOCHEMISTRY OF SUBSURFACE BRINES.
Kansas Univ., Lawrence. Dept. of Civil Engineering; Kansas State Geological Survey, Lawrence; and Louisiana State Univ., Baton Rouge. School of Geology.
For primary bibliographic entry see Field 02K.
W69-06950

SUBSURFACE BRINES AND MINERAL EQUILIBRIA,
McMaster Univ., Hamilton (Ontario). Dept. of Geology.
For primary bibliographic entry see Field 02K.
W69-06952

ON THE EVOLUTION OF SUBSURFACE BRINES IN ISRAEL,
Hebrew Univ., Jerusalem (Israel). Dept. of Geology.
For primary bibliographic entry see Field 02K.
W69-06955

WATER HISTORY OF CRETACEOUS AQUIFERS, EAST TEXAS BASIN,
Albion Coll., Mich.
For primary bibliographic entry see Field 02K.
W69-06956

GEOCHEMISTRY OF SALINE SUBSURFACE WATER, SALINE COUNTY (MISSOURI),
Missouri Univ., Columbia, Dept. of Geology.
For primary bibliographic entry see Field 02K.
W69-06957

CHEMISTRY OF SOME ANADARKO BASIN BRINES CONTAINING HIGH CONCENTRATION OF IODIDE,
Bureau of Mines, Bartlesville. Okla. Bartlesville Petroleum Research Center.
For primary bibliographic entry see Field 02K.
W69-06958

MINOR ELEMENTS IN OIL-FIELD WATERS,
Shell Develop Co., Houston, Tex.; Du Pont de Nemours (E. I.) and Co., Wilmington, Del.; and Perkin-Elmer Co, Silver Spring, Md.
For primary bibliographic entry see Field 02K.
W69-06959

GEOCHEMISTRY AND ORIGIN OF FORMATION WATERS IN THE WESTERN CANADA SEDIMENTARY BASIN, 2. ALKALI METALS,
Louisiana State Univ., Baton Rouge; Research Council of Alberta, Edmonton; and Alberta Oil and Gas Conservation Board, Edmonton.
For primary bibliographic entry see Field 02K.
W69-06960

SOME CHEMICAL ALTERATIONS OF SUBSURFACE WATERS DURING DIAGENESIS,
University of Southern California, Los Angeles. Dept. of Petroleum Engineering.
For primary bibliographic entry see Field 02K.
W69-06961

GEOCHEMISTRY AND HYDRODYNAMICS OF THE PARADOX BASIN REGION, UTAH, COLORADO AND NEW MEXICO,
Geological Survey, Washington, D. C.; and Petroleum Research Corp., Denver, Colo.
For primary bibliographic entry see Field 02K.
W69-06963

WATER RESOURCES OF ANTELOPE COUNTY, NEBRASKA,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
W69-06976

WATER RESOURCES OF THE MISSISSIPPI HEADWATERS WATERSHED, NORTH-CENTRAL MINNESOTA,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
W69-07012

THE ABSENCE OF THRESHOLD GRADIENTS IN CLAY-WATER SYSTEMS,
Illinois Univ., Urbana. Dept. of Agronomy.
For primary bibliographic entry see Field 02G.
W69-07088

DETERMINATION OF HYDROGEOLOGICAL PARAMETERS UNDER THE CONDITIONS OF MUTUAL INTERACTION OF WATER-BEARING HORIZONS (RUSSIAN),
Moscow State Univ. (USSR). Hydrogeological Section.
I. S. Pashovsky.
Moscow Univ Herold, Ser 4, Geol, No 2, pp 100-103, Mar-Apr 1969. 4 p, 2 fig, 5 ref.

Descriptors: *Parametric hydrology, *Aquifers, *Integral circuits, Geology, Sands, Conglomerate rocks, Clays, Marl, Filtration, Density, Water balance, Fissures (Geology), Sedimentary rocks, Boreholes, Pumping, Pressure.
Identifiers: *USSR, Aquifer hydrogeologic parameters, Cisaralian area.

Hydrogeological parameters of hydraulically-associated aquifers were analyzed analytically and experimentally using laboratory models and hydrological and borehole data recorded in the Cisaralian area of the USSR. The filtration coefficients of the aquifers of the Cisaralian area were determined as varying from 0.0001 to 0.0008 m/day. The study shows that the Cisaralian coefficient values determine the mean values characterizing the total area affected by the presence of boreholes and can not be taken as representing the filtration coefficients of the clays separating the water-bearing horizons. (Gabriel-USGS)
W69-07094

THE STATUS OF GEOHYDROLOGY IN INDIA,
Geological Survey of India.
G. C. Chaterji.
Water Resources Bull, Vol 5, No 1, pp 3-18, Mar 1969. 16 p, 2 fig, 2 tab.

Descriptors: *Hydrogeology, *Surveys, Groundwater, Surface waters, Aquifers, Test holes, Irrigation, Industrial water, Irrigation water, Municipal water, Water resources development.
Identifiers: *India, Groundwater investigations.

Groundwater investigations have formed a part of the regular activities of the Geological Survey of India since its inception in 1851. Until 1930, such studies were restricted mostly to problems of rural and urban water-supply. Systematic regional geohydrological studies began in the year 1953. During the period 1953-1959 systematic hydrologic studies in India aided by drilling and testing covered about 1.5 million sq km of unconsolidated to semi-consolidated sediments, mostly in the major sedimentary basins and coastal plains. These studies revealed groundwater reservoir formations as old as the Jurassic. Since 1961 these studies have been supplemented with regional groundwater studies in extensive areas of the soft-rock mantle and also in some of the hard-rock areas. Another 70,000 sq km was covered by 1961. Basin-wide groundwater assessment, exploitation planning and conservation were the primary objectives of these studies. Currently, systematic geohydrological investigations are being continued in all the basins simultaneously with studies into specific water-supply problems for industry and agriculture. Of particular importance are those involving lignite mining operations, seepage from reservoirs into coal mines, reservoir leakage problems, effects of large-scale irrigation on groundwater regime and the fresh-saline water interface in coastal areas. The nature and origin of the thermal springs of India are also being studied intensively. Conventional geophysical methods have been applied widely to estimate thickness of sediments, delineate water-bearing zones, and detect saline water-bearing formations.
W69-07097

WATER RESOURCES OF MEXICO,
Mexico National Univ, Mexico City. Instituto de Geofisica.
For primary bibliographic entry see Field 02E.
W69-07098

KARSTIC HYDROLOGY OF VERCORS (FRENCH),
Jean Loup.
Rev de Geogr Alpine, Grenoble, Vol 57, No 2, pp 329-332, 1969. 4 p.

Descriptors: *Hydrologic properties, *Karst, *Aquifers, Groundwater movement, River basins, Caves, Dye releases, Hydrogeology, Water resources, Pollutants, Chemical analysis, Hydroelectric power, Topography, Rain, Lakes, Water balance, Discharge (Water).
Identifiers: *Vercors, France, Karstic hydrology.

Hydrogeological characteristics of the Vercors, France, karstic area are broadly discussed on the basis of the geological, geographical and hydrological data recorded in 1968. The study shows that the Vercors massif has a weak capacity for water retention in spite of the presence of large numbers of cavities and underground channels in the area. The effect of aquifers is noticeable during the dry years only, and it is probable that these aquifers are fed by snowmelts and rainstorms of considerable intensity. (Gabriel-USGS)
W69-07122

2G. Water in Soils

RELATIVE FACTORS INFLUENCING MEMBRANE FILTRATION EFFECTS IN GEOLOGIC ENVIRONMENTS,
California Univ., Berkeley. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 02K.
W69-06964

AVAILABLE AND ACCESSIBLE WATER,
Rothamsted Experimental Station, Harpenden (England).
H. L. Penman.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 29-37, 1968. 9 p, 2 fig, 6 ref.

Descriptors: *Soil water movement, *Soil-water-plant relationships, *Evapotranspiration, Diffusion, Diffusivity, Moisture, Plant growth, Root systems, Water balance.
Identifiers: Drying, Water availability.

Measurements on a loam soil gave a diffusivity ranging from 20 sq cm/day at the wilting point to 200 sq cm/day near field capacity. Starting with these data, transfer rates are calculated for a complete crop cover on such a soil, with the root system arranged in parallel sheets 40 cm deep at 2 spacings, 2 and 20 cm, with and without a deep subsoil, for 2 imposed rates of potential evaporation, 0.2 and 0.6 cm/day, and with all further resistance either wholly in the atmosphere or all in the plant. Drastic mathematical and physical assumptions are necessary. Results are curves of accumulated actual evaporation, against accumulated potential evaporation. The curves vary as greatly as published field experience. The main results are: (1) the larger potential evaporation, the smaller the value of total potential evaporation at which total actual evaporation becomes less than total potential evaporation; (2) at close spacing (dense root system) it is immaterial whether the external resistance is in the plant or in the atmosphere, but at wide spacing plant resistance (if any) can cause an early check to transpiration; (3) when there is no subsoil, the Veihmeyer concept is very nearly exact, particularly at the lower rate of potential evaporation.
W69-06984

ON THE WATER BALANCE OF GRASSLAND AND FOREST,
Commonwealth Scientific and Industrial Research Organization, Adelaide (Australia). Div. of Soils.
J. W. Holmes, and J. S. Colville.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 39-46, 1968. 8 p, 3 fig, 3 tab, 6 ref.

Descriptors: *Forests, *Grasslands, *Water balance, *Hydrologic budget, *Soil-water-plant relationships, Evapotranspiration, Rainfall, Moisture stress, Recharge, Surface-groundwater relationships, Aquifers.
Identifiers: Australia.

Lysimeters were used for the measurement of drainage through the soil profile and the neutron moisture meter was used for the measurement of soil water content and estimation of drainage to study the water balance of grassland and forest in a region enjoying 700 mm annual rainfall. Recharge to water-table aquifer was 60 mm per year under grassland and zero under forest. Evaporation during winter and spring, which is the growing season

free from soil water stress, was greater from forest than it was from grassland by a factor of about 2. Increment of soil water during the same season was typically about 230 mm in the soil profile beneath grassland and about 120 mm in the soil profile beneath forest.
W69-06985

QUANTITATIVE MODEL OF MOISTURE FLOW IN THE PLANT-SOIL SYSTEM,
Hydrometeorological Service of the USSR (Moscow).
I. I. Sudnitzin.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 47-55, 1968. 9 p, 2 fig, 9 ref.

Descriptors: *Soil-water-plant relationships, *Soil water movement, Moisture stress, Diffusion, Water pressure, Osmotic pressure, Evapotranspiration, Transpiration, Water balance, Mathematical models.
Identifiers: Potential evapotranspiration.

A quantitative model of water movement in the soil-plant-atmosphere system is presented. The model was based on thermodynamical principles postulating the linear relationship between flux density and the potential gradient, the relationship between the hydraulic conductivity and the total soil water pressure, obtained on the basis of soil pore size distribution, and the relationship between relative transpiration and the total soil water pressure, estimated empirically in a pot experiment and confirmed by analyzing the meteorological data for many years. By this model it is possible to calculate the relationship between the water pressure in the plant roots and the soil water pressure, if the potential evapotranspiration, active root surface and some constants are known. The experimental control confirms the validity of this model as a first approximation. It appears that in the range of 0 to -15 bar, root pressure decreases more rapidly than soil water pressure and thus the water pressure head between roots and soil increases uninterruptedly. When soil water pressure becomes small, the leaf surface area becomes smaller by leaf shedding (the range of 'passive' adaptation). At a soil water pressure of -25 bar, the root to soil pressure difference becomes very small, the water flux density also becomes very small and plants die. Under given meteorological conditions the value of the pressure difference is proportional to the potential evapotranspiration.
W69-06986

AN EXPERIMENTAL STUDY OF EVAPORATION FROM UNIFORM SOIL COLUMNS IN THE PRESENCE OF A WATER TABLE,
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agriculture Research.
For primary bibliographic entry see Field 02D.
W69-06987

THE EFFECT OF TEMPERATURE GRADIENT ON MOVEMENT OF SOIL WATER,
Slovak Academy of Sciences, Bratislava (Czechoslovakia). Inst. of Hydrology and Hydraulics.
J. Sutor, and V. Novak.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 85-93, 1968. 9 p, 4 fig, 15 ref.

Descriptors: *Evaporation, *Soil water movement, *Soil water, Temperature, Drying, Diffusion, Percolation, Heat flow, Mass transfer, Thermal stress, Moisture stress, Thermodynamics.
Identifiers: Thermal gradients, Moisture gradients.

The influence of a temperature gradient within a soil column upon the loss of water from the exposed surface of one end was investigated experimentally using a packed column 15 cm long. The surface was maintained cooler than the soil beneath it, and a set of water content profiles in the soil was obtained for the conditions; initial water content of the soil 0.21 cc per cc, temperature gradient 1 deg C/cm, mean temperature 29 deg C, bulk density of the soil 1.20 g/cc and 7 relative vapor pressures at the evaporating surface between 0.01 and 1.0. Similar experiments were performed with isothermal water movement in the soil. The evaporation was about 3 times as large, when the temperature gradient assisted the flow of water to the surface. By computation, using the experimentally determined values of temperature gradient and water flux, the coefficient for water flow under a temperature gradient was determined to be about .00003 sq cm/sec deg C with a maximum content of 0.21 cm per cm.
W69-06988

THE SIGNIFICANCE OF THE EXTERNAL WATER POTENTIAL AND OF SALT TRANSPORT TO WATER RELATIONS IN PLANTS,
California Univ., Riverside. Dept. of Soils and Plant Nutrition.
J. J. Oertli.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 95-107, 1968. 13 p, 6 fig, 1 tab, 18 ref.

Descriptors: *Soil-water-plant relationships, *Soil water movement, *Plants, Moisture stress, Thermodynamics, Thermodynamic behavior, Free energy, Chemical potential, Solutes, Osmotic pressure, Mass transfer, Salinity.
Identifiers: Water potential.

Effects of the external water potential and of solute-water interactions on plant behavior were investigated. Maintenance of turgor pressure in plants grown in external solutions of different osmolalities does not preclude a growth reduction under saline conditions through an effect of water relations. Through solute uptake, elongating cells must continuously adjust the turgor pressure in the volume they are gaining. From salt transport characteristics, an optimum concentration may be predicted at which this adjustment is most rapid. Toward both lower and higher saline concentrations, growth rates through cell elongation are reduced. It is shown that salt depletion or accumulation during xylar water flow changes requirements for osmotic adjustment in plants. It is postulated that salt burns may be the result of such an extracellular salt accumulation. Conversely extracellular salt depletion should have a beneficial effect. These changes of foliar extracellular salt concentrations are not properly considered when the osmolality of the expressed leaf sap is used to test a possible turgor adjustment. It is concluded that plant responses to saline conditions can only partly be explained by the energy status of the external water and that static and dynamic aspects of solutes in plants, both intra- and extracellular must properly be considered.
W69-06989

THE USE OF EXCHANGE ISOTHERMS TO DETERMINE DIFFUSION COEFFICIENTS IN SOIL,
Oxford Univ. (England). Soil Science Lab.
P. H. Nye.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 117-126, 1968. 10 p, 3 fig, 19 ref.

Descriptors: *Diffusion, *Soil water movement, *Solutes, *Ion transport, Mass transfer, Diffusivity, Ion exchange, Leaching, Soil chemical properties.
Identifiers: Exchange isotherms, Chemical potential gradients, Concentration gradients.

Theories of the conductivity of heterogeneous materials may be used to derive concentration dependent differential diffusion coefficients of ions in soils and clays in terms of their mobility on the solid and in the liquid. In practice, for K, Na, H, Sr and phsophate, only a small error is made by assuming that these ions are mobile in the solution. The diffusion coefficients then depend mainly on the slope of the exchange isotherm and on the soil moisture content, which controls the impedance factor. In evaluating the slope of the exchange isotherm, the exchanging ion, the total solution concentration, and the possibility of indefinite equilibration must be considered. Impedance factors for gas diffusion and ion diffusion are fairly similar. It should prove easier to obtain differential diffusion coefficients from the slopes of isotherms and the moisture content than to measure them directly.
W69-06990

THE IMPORTANCE OF MASS FLOW IN THE UPTAKE OF IONS BY ROOTS FROM SOIL,
Oxford Univ. (England). Dept. of Biomathematics; and Oxford Univ. (England). Dept. of Agriculture.
For primary bibliographic entry see Field 02I.
W69-06991

NUTRIENT TRANSPORT TO PLANT ROOTS,
Wisconsin Univ., Madison, Dept. of Soils.
For primary bibliographic entry see Field 02I.
W69-06992

LYSIMETRIC OBSERVATIONS ON THE LEACHING OF ELEMENTS IN PODZOLIC SOILS,
Dokuchayev Central Soil Museum, Leningrad (USSR).
V. V. Ponomareva, T. A. Rozhnova, and N. S. Sotnikova.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 155-164, 1968. 10 p, 1 fig, 3 tab, 6 ref.

Descriptors: *Leaching, *Podzols, *Lysimeters, Water quality, Water chemistry, Humid climates, Forests, Forest soils, Trees, Infiltration, Solutes, Sorption, Ion exchange.
Identifiers: Forest floor.

The composition of lysimeter water from different genetic horizons of a sandy illuvial humus polzol and a soddy podzolic loamy soil, both from the Leningrad region, was studied. The amounts of some nutrient elements leaching from the litter of the podzol were negligible, being of the same order as the amounts entering the soil from the atmosphere. The leaching of the same elements from the litter of the soddy podzolic soil was greater. The predominant amounts of the elements leached were retained by the A-1 horizon. This phenomenon may be related both to the formation of the A-1 horizon under the A-0 horizon and the A-2 horizon under the A-1 horizon in the soddy podzolic soil profiles. Almost all elements entering the A-1 horizons of the soddy podzolic soil were retained there, varying from 20 to 80% retention. Most elements were leached from the A-2 horizon in greater amounts than that of their entry from the A-1 horizon; this was evidence of the current podolizing process. The transitional A-2 B horizon should be regarded as the horizon of most active podzolization due to the high amount of silicate mineral elements being leached from it. Desilication, together with iron and aluminum retention, were characteristics of the B Horizon of the soddy podzolic soil. On the other hand the sandy podzol was characterized by different features of element migration and accumulation from solution.
W69-06993

HYDROLOGICAL PROFILE OF THE SOIL,
AKADEMIYA Nauk SSSR, Moscow. Pochvennyi Institut.
A. A. Rode.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 165-172, 1968. 8 p, 4 fig, 1 tab, 4 ref.

Descriptors: *Soil moisture, *Soil water movement, *Soil-water-plant relationships, Infiltration, Drying, Percolation, Moisture availability, Moisture tension, Drainage, Water table, Zone of aeration, Root zone.
Identifiers: Soil water horizons, Soil hydrological horizons.

Soil water is not evenly distributed, but occurs in distinguishable horizons. Soil water mobility is distinctly different in each horizon, and it may be described by 4 water-content parameters: (1) total capacity; (2) minimum retention capacity; (3) capillary bond rupture content; and (4) wilting point content. A soil hydrological horizon is defined as a zone with a definite mobility, based on these 4 parameters. The 7 horizons described are: total capacity (1); capillary saturation (between 1 and 2); minimal saturation (2); weak desiccation (between 2 and 3); intensive desiccation (between 3 and 4); total biological desiccation (4); and physical desiccation (less than 4). Soil moisture profiles of solonchak-solonetz, southern chernozem, and derno-podzolic soils are used as illustrations. Wetting and drying do not proceed uniformly with depth and time, but hydrological horizons fill with water or dry one at a time. (Knapp-USGS)
W69-06994

BINGHAM FLOW IN CAPILLARY-POROUS MEDIA,
Agrofizicheskii Nauchno-Issledovateiskii Institut, Leningrad (USSR).
N. P. Bondarenko.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 205-212, 1968. 8 p, 2 fig, 2 tab, 7 ref.

Descriptors: *Soil water movement, *Rheology, *Plasticity, *Hydrogen bonding, *Capillary action, Darcy's law, Porous media, Water properties, Water structure.
Identifiers: Non-Newtonian flow, Hydrogen-bonded liquids, Buckingham-Reiner equation, Bingham flow.

Cappillary-flow experiments run at low pressure gradients in quartz and glass tubes show that the flow velocity of some pure hydrogen-bonded liquids such as water, alcohol, etc., is not proportional to the gradient. Such liquids are strictly non-Newtonian, with plastic viscosities of the order of 0.01 to 0.001 dynes/sq cm. Capillary flow of these liquids may be described by the Buckingham-Reiner equation. The flow of liquids without hydrogen bonds is Newtonian. For hydrogen-bonded liquids, Darcy's law is not generally valid. (Knapp-USGS)
W69-06995

SOLUTE AND SOLVENT FLOW AS INFLUENCED AND COUPLED BY SURFACE REACTIONS,
Colorado State Univ., Fort Collins; Agricultural Research Service, Washington, D. C.; and California Univ., Riverside.
W. D. Kemper and J. Letey.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 233-241, 1968. 9 p, 1 fig, 10 ref, 1 append.

Descriptors: *Soil water movement, *Aqueous solutions, *Porous media, *Sorption, Clays, Ion exchange, Ion transport, Osmosis, Electrolytes, Solutes, Salts, Thermodynamics, Mathematical models, Hydraulic conductivity, Filtration.
Identifiers: Surface chemistry.

The influence of surface-reactions on the flow of solutions through porous media is analyzed mathematically. Temperature gradients caused by viscous dissipation of energy are not large enough to invalidate the approximation of isothermal flow in the analysis. The Onsager reciprocal relationship holds approximately. Soil-solute interactions are determined by adsorption and hydrodynamic factors and not by geometrical factors. (Knapp-USGS)
W69-06996

THE SIMULTANEOUS FLOW OF WATER AND HEAT OR SOLUTES THROUGH SOIL,
Utah State Univ., Logan. Dept. of Soils and Meteorology.
A. Hadas, and S. A. Taylor.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 243-251, 1968. 9 p, 1 fig, 2 tab, 18 ref, 1 append.

Descriptors: *Ion transport, *Soil water movement, *Mathematical models, Thermodynamics, Mass transfer, Heat flow, Aqueous solutions, Energy transfer, Equilibrium, Heat transfer.
Identifiers: Irreversible thermodynamics.

A mathematical model uses nonlinear equations to describe the simultaneous flow of water, heat, and solutes through soil, in response to thermal, pressure, and chemical gradients. Solutions obtained with the model were compared with experimental data and were found not to explain real behavior. The discrepancies may be in the assumptions of transport mechanisms or in the validity of the irreversible thermodynamic processes used in the model. The amount of disequilibrium of the real system that may be represented in the mathematical model also has an unknown effect. Despite these problems, the thermodynamic approach appears to be a promising field for further work. (Knapp-USGS)
W69-06997

NON-LINEAR THERMODYNAMICS OF IRREVERSIBLE PROCESSES APPLIED TO SOIL-WATER SYSTEMS,
Punjab Agricultural Univ., Hissar, (India).
R. C. Srivastava, and I. P. Abrol.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 253-262, 1968. 10 p, 21 ref.

Descriptors: *Soil water movement, *Ion transport, *Heat flow, Mathematical models, Thermodynamics, Mass transfer, Aqueous solutions, Energy transfer, Equilibrium.
Identifiers: Irreversible thermodynamics.

An attempt was made to arrive at a generalized theory of transport processes in soil systems by taking into account the non-linear phenomenological relations and also the higher order symmetry relations in addition to Onsager's reciprocal relations. Interrelated rate equations for the transport of matter and energy through soil systems in the non-linear region were obtained. Methods for evaluating the additional phenomenological coefficients occurring in the non-linear rate equations are outlined in principle so that these non-linear phenomenological equations may have a predictive value. Generalized equation for the flow of water through soils which reduces to Darcy's law in the linear region has been shown to be a consequence of such a treatment. The generalized flow equation thus obtained is in agreement with the empirical finding of earlier workers. An attempt was made to work out the transport of water through soils under the influence of temperature gradients. Generalized rate equations for thermally driven water through soils were obtained, and reduce to those derived by Cary and Taylor in the linear region.
W69-06998

A STUDY OF WATER MOVEMENT TOWARDS THE DRYING ZONE DEPENDING ON SOIL CONDITIONS,
Agrofizicheskii Nauchno-Issledovatelskii Institut, Leningrad (USSR).
N. A. Sokolovskays, I. B. Revut, and S. V. Nerpin.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 263-271, 1968. 9 p, 3 fig, 1 tab, 8 ref.

Descriptors: *Soil water movement, *Drying, *Soil-water-plant relationships, Permeameters, Hydraulic models, Moisture stress, Capillary action, Root zone, Soil moisture, Soil physical properties, Soil structure.
Identifiers: Water tension.

Infiltration apparatus was constructed to study water movement in soil samples of different particle size, structural composition and density. It allows measurement of soil water tension while water moves to a drying zone created with a filter through which the necessary suction is maintained. This apparatus has been used for studying water movement in structured soils. Tension isopleths of soil water were obtained for undispersed samples of a well structured deep clay-loam chernozem, and for fractions of different size. These allowed consideration of the process of water movement to the consumption zone in a structured soil. It is established that with soil water reduction below field capacity, regular water movement to the consumption zone is observed in pores of 60-15 micron. When water moves in smaller pores, gradual capillary bond rupture occurs first in larger pores and then in smaller ones. Water bonds between soil aggregates in a deep clay-loam chernozem remain up to pF of 2.6. Capillary bond rupture in pores of 7-5 micron results in the breaking of water bonds between aggregates. Moisture content at capillary bond rupture (MCR) in the soil considered was 32% of dry weight.
W69-06999

FACTORS DETERMINING THE HYDRAULIC CONDUCTIVITY OF RED MEDITERRANEAN SOILS AND DERIVED TYPES,
Water Planning for Israel Ltd., Tel-Aviv.
J. E. Berend, and S. Kary.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 273-282, 1968. 10 p, 1 fig, 2 tab, 9 ref.

Descriptors: *Soil water movement, *Hydraulic conductivity, *Soil types, *Infiltration, Irrigation, Water spreading, Leaching, Soil physical properties, Soil chemical properties, Clays, Artificial recharge, Drying, Water reuse.
Identifiers: *Israel, *Red Mediterranean soils, Pseudogley, Hamra soils, Soil reclamation.

The hydraulic characteristics of Red Mediterranean ('Hamra') soils, and the pseudogley ('Nazzaz') soils derived from them were investigated, using test infiltration ponds up to 1 ha area. Two typical situations were encountered, namely the normal soil profile and a soil profile which had been covered by dune sand. The red soils are invariably very permeable. The pseudogleys are much less pervious. The exchange complex is dominated by Ca and Mg carbonates, which are completely leached only from exposed soils. Leaching water tended to dissolve alkaline-earth carbonates from the uppermost layer of the soil profile which became clogged after the exhaustion of the carbonate reserves. The accelerated illuviation leading to pseudogley formation does not occur under dunes, which prevent extreme drying and cracking. Therefore, the deterioration into pseudogley is assumed to pre-date the dune invasion. Some increase in permeability of the underlying soil occurred with leaching of alkaline-earth carbonates from the invading dunes. This process, probably lasting for hundreds of years, improved the structure of the underlying soil and increased the hydraulic conductivity up to 100-fold. The findings indicate that the correct management of water-spreading grounds involves replenishing the carbonate content and avoiding accelerated illuviation in soils not covered with sand dunes. Liming should be an essential step in the reclamation of the pseudogley described here.
W69-07000

SALT ACCUMULATION PROCESSES IN THE HUNGARIAN DANUBE VALLEY,
Magyar Tudomanyos Akademia Talajtani es Agrokemiai Kutato Intezete, Budapest.
For primary bibliographic entry see Field 03C.
W69-07002

HYDRAULIC CONDUCTIVITY OF SOME TROPICAL SOILS AS A GUIDE TO IRRIGATION WATER QUALITY,
Hawaii Univ., Honolulu. Coll. of Tropical Agriculture; Hawaii Inst. of Geophysics, Honolulu; and Hawaii Univ., Honolulu. Dept. of Agronomy and Soil Science.

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For primary bibliographic entry see Field 03C.
W69-07003

QUALITY OF IRRIGATION WATER,
Indian Council of Agricultural Research, New Delhi; and Punjab Agriculture Univ., Hissar (India).
For primary bibliographic entry see Field 03C.
W69-07004

SOIL AND SALINITY FACTORS IN IRRIGATION AND DRAINAGE OF MALLEE LANDS,
Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).
F. Penman.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 415-423, 1968. 9 p, 3 tab, 24 ref.

Descriptors: *Irrigation water, *Water quality, *Salinity, *Drainage, *Saline soils, Leaching, Soil chemical properties, Soil physical properties, Permeability, Hydraulic conductivity, Soil types, Soil structure, Clays, Sands, Infiltration, Waterlogging.
Identifiers: *Australia, Mallee Soils (NSW), Sodium hazard.

With dune and swale topography and catenal sequences from very light soils on ridges to heavy soils on flats, Australian Mallee soils under irrigation are specially subject to problems of water logging and salinity. Minor problems associated with the saline-sodic soils are depressed availability of zinc and iron to plants and the presence of potentially toxic concentrations of water-soluble boron. Artificial under-drainage, mostly by agricultural tile, has alleviated the major problems of excess soil water and toxic salinity and also that of boron toxicity. Removal of water-soluble boron by leaching these soils is however a slow process. Zinc deficiency in such crops as citrus and vines is controlled by application of zinc compounds to the plants. High-alkalinity chlorosis due to iron deficiency is best controlled by application to the soil of a particular type of chelated iron. There is still much scope for improvement in irrigation practice to minimize overloading of drainage systems. Necessary steps include separate handling of light land, preferably by sprinkler irrigation of length of irrigation run and use of larger flows is indicated. Especially for the first 2 irrigations in the spring, running of watering furrows directly above drainage trenches should be avoided.
W69-07006

THE ABSENCE OF THRESHOLD GRADIENTS IN CLAY-WATER SYSTEMS,
Illinois Univ., Urbana. Dept. of Agronomy.
Raymond J. Miller, Allen R. Overman, and John H. Peverly.
Soil Sci Soc Amer Proc, Vol 33, No 2, pp 183-187, Mar-Apr 1969. 5 p, 6 fig, 20 ref.

Descriptors: *Flow, *Porous media, *Clays, Darcys law, Saturated flow, Unsteady flow, Hydraulic properties, Permeability.
Identifiers: Threshold flow gradients.

A transient-pressure transducer and recorder were used to test clay-water systems for threshold gradients in nonlinear transient-saturated flow. In samples of 9, 30, 40, and 50 weight percent montmorillonite and kaolinite, no threshold gradients were measured with initial heads of 12.5-93 cm of water. (Knapp-USGS)
W69-07088

RELATION OF WATER APPLICATION TO EVAPORATION AND STORAGE OF SOIL WATER,
Agricultural Research Service, Fort Collins, Colo. Soil and Water Conservation Research Div.; and Agricultural Research Service, Riverside, Calif. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 2D.
W69-07089

DESIGN AND PERFORMANCE OF AN OSMOTIC TENSIOMETER FOR MEASURING CAPILLARY POTENTIAL,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
For primary bibliographic entry see Field 07B.
W69-07090

INTERDEPENDENCE OF WATER DROP ENERGY AND CLOD SIZE ON INFILTRATION AND CLOD STABILITY,
Agricultural Research Service, Iowa City, Iowa; Iowa Agricultural and Home Economics Experiment Station, Ames; and Colorado Agricultural Experiment Station, Fort Collins.
W. D. Moldenhauer, and W. D. Kemper.
Soil Sci Soc Amer Proc, Vol 33, No 2, pp 297-301, Mar-Apr 1969. 5 p, 8 fig, 3 tab, 17 ref.

Descriptors: *Infiltration, *Impact (Rainfall), Pudding, *Soil structure, Soil strength, Soil surfaces, Soil texture, Runoff, Erosion, Permeability.
Identifiers: Raindrop energy, Clod stability.

The decline of intake rates with successive increments of applied water drop energy in various sizes of soil fragments of 2 Iowa and 2 Colorado soil types was studied. There was a wide spread between intake rate of the 8- to 20-mm size range and those of all other sizes after the first increment (1.25 cm as 5-mm drops) was applied. The intake rate of the 8- to 20mm size declined rapidly after the first or second increment. Final intake rates were not correlated with aggregate stability. There was a negative correlation between clay content and final intake rates. Final intake rates after disintegration of large soil fragments in many cases were lower than when initial size ranges were small.
W69-07091

HEXADECANOL IN SOIL- ITS LOCATIONAL STABILITY AND INFLUENCE ON MODULUS OF RUPTURE,
Arizona Agricultural Experiment Station, Tucson; and Arizona Univ., Tucson. Dept. of Agricultural Chemistry and Soils.
Matts A. Myhrman, and D. D. Evans.
Soil Sci Soc Amer Proc, Vol 33, No 2, pp 203-205, Mar- Apr 1969. 3 p, 2 tab, 9 ref.

Descriptors: *Soil structure, *Soil amendments, *Hexadecanol, *Soil water movement, Soil aggregates, Soil texture, Soil treatment, Soil chemical properties, Soil physical properties, Permeability, Soil management, Soil strength.
Identifiers: Hexadecanol in soil.

Modulus of rupture was reduced 65% for a sandy loam soil and 57% for a silt loam soil by addition of 0.4% (by weight) dry powdered hexadecanol. Emulsified hexadecanol, powdered commercial tallow alcohol, and smaller dosages had less effect. Less than 2% of the C-14 tagged hexadecanol placed in a 1-cm thick layer of sandy soil moved under either saturated or unsaturated flow conditions. Movement probably took place in the form of small buoyant particles.
W69-07092

SOME ASPECTS OF TWO-DIMENSIONAL INFILTRATION,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research and Regional Survey.
A. J. Peck, and T. Talsma.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 11-12, 1968. 11 p, 2 fig, 3 tab, 12 ref.

Descriptors: *Soil water movement, *Infiltration, *Diffusion, Irrigation, Unsaturated flow, Capillary action, Percolation, Unsteady flow, Soil physical properties, Mathematical studies, Furrow irrigation.
Identifiers: Gravity effects (Infiltration).

Experiments on infiltration from a horizontal semicylindrical furrow into several soils and other porous media have provided data to test recently proposed approximate solutions for the cumulative infiltration. Within the limits of possible experimental errors, the theories appear to be adequate, but in the case where two are applicable it is not possible to say which is the better. The effects of gravity are less important in furrow than in one-dimensional infiltration because of the concentrated flux of water in soil close to the furrow. After an initial period, and before gravity is important, the infiltration rate from a furrow is nearly, but never quite, constant. Gravity effects further reduce changes of infiltration rate. In a comparison of media with very different pore size-distributions, gravity effects on cumulative infiltration were greater in the less permeable material. This behaviour is not expected of scaled media with similar pore-size distributions.
W69-07133

APPLICATION OF NON-LINEAR EQUATION OF UNSTEADY WATER FLOW IN SOILS,
Agrofizicheskii Nauchno-Issledovatelskii Institut, Leningrad (USSR).
S. W. Nerpin, G. I. Jusefowitsch, and W. A. Jangarber.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 23-28, 1968. 6 p, 1 fig, 1 tab, 6 ref.

Descriptors: *Soil water movement, *Unsteady flow, *Unsaturated flow, *Mathematical models, Computer programs, Percolation, Irrigation, Infiltration.
Identifiers: Finite-difference methods.

A non-linear equation is presented for a description of water flow in soils in the non-steady state and some theoretical questions are discussed concerning the problems of boundary values of such an equation. The uniqueness of the soltuion of the first problem of boundary values is proved. A family of finite-difference equations for the numerical solution of the problem with boundary values has been established. Using a digital computer, the influence of the coefficient A on the solution of the above mentioned problem has been investigated. If A is a stepwise function of the depth x, then the calculated moisture profiles agree reasonable with the experimental data.
W69-07134

EVAPORATION FROM BARE SOIL UNDER HIGH RADIATION CONDITIONS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research and Regional Survey.
For primary bibliographic entry see Field 02D.
W69-07135

CONSUMPTION OF WATER BY PLANTS DEPENDING ON THE NEGATIVE PRESSURE OF THE SOIL WATER,
Akademiya Nauk SSSR. Laboratoriya Lesovedeniya.
For primary bibliographic entry see Field 02I.
W69-07136

LEACHING OF FERTILIZER IONS IN SOIL COLUMNS,
Western Australia Univ., Nedlands. Dept. of Soil Science and Plant Nutrition.
For primary bibliographic entry see Field 05B.
W69-07137

TRANSPORT OF ATRAZINE IN A LATOSOLIC SOIL IN RELATION TO ADSORPTION, DEGRADATION, AND SOIL WATER VARIABLES,
Hawaii Univ., Honolulu. Dept. of Agronomy and Soil Science.
For primary bibliographic entry see Field 05B.
W69-07139

SOME EFFECTS OF DRAG ON THE STRUCTURE AND HYDRAULIC CONDUCTIVITY OF SOIL,
Commonwealth Scientific and Industrial Research Organization, Adelaide (Australia). Div. of Soils.
T. J. Marshall.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 213-221, 1968. 9 p, 2 fig, 2 tab, 11 ref.

Descriptors: *Soil water movement, *Soil structures, *Hydraulic conductivity, Hydraulic models, Permeameters, Cohesive soils, Hydraulics, Fluid mechanics, Pores, Porous media.
Identifiers: Hydraulic drag.

When water flows through a bed of unstable material, the hydraulic conductivity can be affected by detachment of particles or by a change in volume of the material. These two consequences of drag are related respectively to hydraulic gradient at any given position in the bed and to the loss in head between the surface of the bed and that position. The bulk density of 2 columns of artificially packed soil increased and the hydraulic conductivity decreased with increasing head of water during downward flow. Within the columns, bulk density decreased and conductivity increased with height. The effective stress arising from drag and overburden of particles is discussed in relation to laboratory measurements of conductivity when these have to be made on easily deformable material. Although conductivity of the columns was greatly reduced after each increase of head, it otherwise changed little with time. This is ascribed to the measures taken to control detachment and the other possible causes of changing conductivity.
W69-07140

WATER CONSERVATION IN THE SUBHUMID, NORTH LATITUDE PART OF THE CORN BELT OF UNITED STATES,
Agricultural Research Service, Morris, Minn. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 03F.
W69-07141

THE EFFECT OF GYPSUM ON THE WATER STORAGE IN A SANDY LOAM SOIL UNDER AN IRRIGATED PERENNIAL PASTURE,
Commonwealth Scientific and Industrial Research Organization, Riverina (Australia). Riverina Lab.
For primary bibliographic entry see Field 03F.
W69-07142

THE ACHIEVEMENTS OF DRAINAGE THEORY IN RELATION TO PRACTICAL NEEDS: TAKING STOCK,
Agricultural Research Council, Cambridge (England). Unit of Soil Physics.
E. C. Childs.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 349-356, 1968. 8 p, 23 ref.

Descriptors: *Drainage, *Subsurface drainage, *Drainage systems, *Soil water movement, Hydraulic conductivity, Dupuit-Forchheimer theory, Groundwater movement, Steady flow, Unsteady flow, Saturated flow, Unsaturated flow, Digital computers, Mathematical models.
Identifiers: Drainage theory (Review).

During the last 30 years drainage theory has developed more rapidly than its application, and until this lack of balance is corrected further advances must be somewhat academic. Application needs advances in the estimation of soil parameters and interpretation of agricultural need in terms of physical requirements. But even now an understanding of theory helps the consultant to make broad conclusions about large scale land reclamation projects. For example, in the project at Lake Mariyut in Northern Egypt, it has been possible to forecast a steady water table under irrigation in spite of seasonal fluctuations of intensity of application, and limits between which that water table will eventually lie. Furthermore it has been possible to suggest a program of water-table observations during the early years of undrained irrigation which will give information as to the depth of any impermeable layer which may be present, and thus to assess where, between the estimated limits, the water table lie.
W69-07143

MELIORATIVE EFFECT OF DIRECT ELECTRIC CURRENT ON LEACHING SOLONCHAKOUS SOLONETZ,
Moscow State Univ. (USSR). Faculty of Biology and Soil.
A. F. Vadyunina.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 455-463, 1968. 9 p, 2 fig, 3 tab, 9 ref.

Descriptors: *Saline soils, *Leaching, *Electro-osmosis, *Subsurface drainage, Chlorides, Irrigation, Drainage, Land reclamation, Salinity, Salts, Sulfates, Sodium compounds.
Identifiers: *USSR, Solonchak, Solonetz.

The meliorative effect of a direct electrical current on alkaline and saline soils by increasing the efficiency of leaching has been described. The electric current accelerates leaching of salts from the soil due to a directed movement of the ions (electrolysis) and the soil solution (electro-osmosis) to the cathode, the drain. Rate of salt removal at a current of 1 mA/sq cm is twice as low compared to desalinization at a current of 2 mA/ sq cm. The electric current, depending on its density, reduces 15 times the time of solonetz-solonchaks leaching; in the case of permeable soils such as solonchak the efficiency of the current is considerably lower. On the other hand, efficiency of the water used at lower current density is higher owing to slower movement of water and its prolonged action on the soil. Simultaneously with desalinization, desolonetzization also takes place which in the course of usual leachings results in much larger water and time requirements especially in soda-salinized solonetzic soils. In the case of leaching of solonchaks with water combined with electric current no solonetzization takes place, usually observed when leaching with water alone. The current influence substantially improves the physical properties of soils; the content of fine particles is reduced, and that of water stable micro- and macro-aggregates increased and the water conductivity of soil also increased thus facilitating leaching of impermeable soils. Meliorative effect of the current is almost proportional to the quantity of the electricity passed through the soil.
W69-07145

THE SALTING FACTORS OF IRRIGATED SOILS IN THE TURAN PLAIN,
Akademiya Nauk Kazakhskoi SSR, Alma-Ata. Institut Pochvovedeniya.
For primary bibliographic entry see Field 03C.
W69-07146

WATER REPELLENT SANDS,
Commonwealth Scientific and Industrial Research Organization, Adelaide (Australia). Div. of Soils.
R. D. Bond.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 339-347, 1968. 9 p, 4 fig, 11 ref.

Descriptors: *Impervious soils, *Sands, *Organic matter, Oil, Humus, Humic acids, Infiltration, Crop production, Crop response, Infiltrometers.
Identifiers: *Australia, *Impervious sands.

Many sandy soils in Australia are not wetted readily by water. Rainwater penetrates into such soils through narrow columns leaving the intervening soil quite dry. Where the intensity of repellence is high, these dry patches, devoid of plant growth, may persist through the wet winter period. The water repellence is caused by organic coatings which prevent the water films from spreading over the sand as the advancing contact angle of wetting with water is frequently greater than 90 deg. The effect of these water repellent coatings on penetration of water into soil is discussed and shown to be the factor limiting infiltration rates into repellent sands. Field observations and tests have shown that the degree of repellence varies with the type of plant cover and age of pasture.
W69-07148

WATER CAPTURE IN SOIL SURFACE MICRODEPRESSIONS FOR CROP USE,
Agricultural Research Service, State College, Miss.; and Agricultural Research Service, Watkinsville, Ga. Soil and water Conservation Research Div.
For primary bibliographic entry see Field 03F.
W69-07149

THE ANISOTROPIC NATURE OF LIQUID FLOW IN CLAY-WATER SYSTEMS,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Div. of Soils.
A. V. Blackmore.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 223-231, 1968. 9 p, 4 fig, 11 ref.

Descriptors: *Soil water movement, *Clays, *Anisotropy, Bentonite, Kaolinite, Electrical conductance, Hydraulic conductivity.
Identifiers: Formation factor.

Methods are described for obtaining permeability and electrical conductance of clay pastes as a function of their particle orientation relative to the direction of the potential gradient. Measurements are made with montmorillonite and kaolin clays over a wide range of porosity (interparticle spacing) and the effect of free electrolyte is studied. The results show that these transport properties are extremely sensitive to the internal arrangement of the pastes, both properties being several times larger when the material is aligned parallel to the flow direction than in the orthogonal situation. It appears that tortuosity is the dominant factor in this difference. Conductance data, in association with the simple geometry in the case of orientation parallel to the gradient, may be used to estimate hydrodynamic tortuosity in some circumstances.
W69-07151

DYNAMIC MEASUREMENT OF THE HYDROLOGIC CHARACTERISTICS OF UNSATURATED POROUS MATERIALS,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
K. K. Watson.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 283-290, 1968. 8 p, 2 fig, 19 ref.

Descriptors: *Soil water movement, *Hydraulic conductivity, *Infiltration, *Soil moisture meters, *Soil physical properties, Nuclear moisture meters, Piezometers, Instrumentation, Permeameters Tensiometers, Drainage, Permeability, Unsaturated flow, Hydraulic conductivity, Porosity.
Identifiers: Gamma-attenuation moisture meters.

The increasingly important role of a dynamic approach to the measurement of the hydrologic characteristics of porous materials is discussed and the specification for such measurement outlined. This specification is met satisfactorily by the well known gamma attenuation method for water content measurement and by a tensiometer-pressure transducer assembly for pressure head measurement. Correction procedures for response errors for each system are detailed together with studies on the sensitivity of the tensiometer-pressure transducer assembly. These studies concern the effect on the pressure output of temperature variations and the response behaviour of the unit under conditions of changing pore air pressure. The application of dynamic measurement to the determination

of the hydraulic conductivity-water content relationship is outlined and a system-dependent effect in the pressure head-water content relationship as measured in a stratified column (fine over coarse sequence) is described.
W69-07152

THE EFFECT OF FLUCTUATIONS IN FLUID VELOCITY ON HYDRODYNAMIC DISPERSION,
Commonwealth Scientific and Industrial Research Organization, Adelaide (Australia). Div. of Soils; and Agricultural Research Service, Ames, Iowa. Soil and Water Conservation Research Div.
D. A. Farrell, and W. E. Larson.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 173-184, 1968. 12 p, 2 fig, 14 ref.

Descriptors: *Dispersion, *Diffusion, *Capillary action, *Soil water movement, Porous media, Heterogeneity, Mass transfer, Suspension.
Identifiers: *Hydrodynamic dispersion, Capillary flow.

The effect of fluctuations in fluid velocity on dispersal in a straight capillary tube is analyzed mathematically. For sinusoidal oscillations in fluid velocity the partial differential equation describing the changing distribution of the dispersing materials is solved by using the method of separation of variables. The use of this mathematical technique reduces the problem to finding the solution of two simultaneous ordinary differential equations. The analysis is then extended to cover changes in the waveform of the oscillations by using the method of superposition. For periodic oscillations in the velocity of the convecting fluid, the effective diffusion coefficient is shown to depend not only on the diffusion Peclet number but also on the waveform and generalized frequency of the oscillations. For random fluctuations that can be characterized by an exponentially decaying autocorrelation coefficient the effective diffusion coefficient is shown to depend on the diffusion Peclet number and the generalized time scale of the velocity function.
W69-07153

2H. Lakes

CULTURAL EUTROPHICATION IS REVERSIBLE,
Wisconsin Univ., Madison. Lab. of Limnology.
For primary bibliographic entry see Field 05G.
W69-06858

THE REMOVAL OF DISSOLVED PHOSPHATE FROM LAKE WATERS BY BOTTOM DEPOSITS,
A. V. Holden.
Verh Internat Verein Limnol, Vol 14, pp 247-251, July 1961. 4 fig, 2 ref.

Descriptors: *Phosphate, *Lakes, *Cycling nutrients, *Sediment-water inferface, Mud-water interface, Phosphorus, Adsorption, Eutrophication, Algae, Macroaquatic plants, Fertilization.

Phosphate fertilizer was added to Scottish lochs and phosphate loss from the water measured. At low levels of phosphate added (45 micrograms/liter) the expotential expression dc/dt= Kc described phosphate decline; at higher levels, the expression was altered to account for phosphate saturation of the sediment. Removal rates were expressed as KD values, micrograms phosphate/centimeter squared, per milligrams phosphate/liter per day. A KD value of 6.5 for Loch Kinardochy as compared with 0.6 for cores overlain by water (30 to 40 cm) and lacking algae or macrophytes, suggested that attached flora largely accounted for phosphate uptake in the loch. In laboratory experiments involving high phosphate uptake (700 micrograms/cm squared), phosphate increase up to 200 milligram phosphate percent occurred in the sediment aerobic zone (upper 20 millimeters); some phosphate penetrated to 80 millimeters, into anaerobic zone. About 6% of phosphate retained in the aerobic zone was decinormal hydrochloric acid extractable. Development of anerobic zones decreased acid-extractable phosphorus, although author does not state whether reoxidation occurred before extraction. Phosphorus gradients from productive, unfertilized lochs, were similar to fertilized lochs incubated 48 months. (Armstrong-Wis)
W69-06859

EUTROPHICATION – CAUSES AND EFFECTS,
Michigan Univ., Ann Arbor. Dept. of Sanitary and Water Resources Engineering.
For primary bibliographic entry see Field 05C.
W69-07084

FRACTIONATION OF PHOSPHORUS IN LAKE SEDIMENTS: ANALYTICAL EVALUATION,
Connecticut Agricultural Experiment Station, New Haven.
C. R. Frink.
Soil Sci Soc Amer Proc, Vol 33, No 2, pp 326-328, Mar-Apr 1969. 3 p, 9 ref.

Descriptors: *Water chemistry, *Lakes, *Phosphorus compounds, *Analytical techniques, *Evaluation, Oxidation, Colorimetry, Inorganic compounds, Organic compounds, Nutrients, Water analysis.
Identifiers: Phosphorus fractionation.

Methods for the fractionation of P in soils were evaluated in the fractionation of P in lake sediments. Both Al-P and Fe-P may be determined readily and precisely by the Chang and Jackson procedure. Reductant-soluble P was more difficult: modifications of a citrate oxidation procedure utilizing potassium permanganate produced an acceptable method. Large amounts of Fe in the Ca-P extracts caused low results, but this was overcome by limiting the aliquot size. Organic P determined by difference between total and inorganic P was not related to the organic matter content of the sediments. An alternative measure of inorganic P, obtained by summing the inorganic P fractions, yielded values for organic P which were correlated with organic matter.
W69-07093

GERMANIUM IN RECENT SEDIMENTS OF THE BLACK SEA (RUSSIAN),
Akademiya Nauk SSSR. Institut Okeanologii.
For primary bibliographic entry see Field 02J.
W69-07120

LIFE CYCLE AND REPRODUCTION OF EPISCHURA BAICALENSIS SARS (COPEPODA, CALANOIDA) IN LAKE BAIKAL (RUSSIAN),
Akademiya Nauk SSSR. Sibirskoe Otdelenie. Limnologicheskii Institut.
E. L. Afanas'yeva.
Dokl Akad Nauk USSR, Vol 185, No 3, pp 693-696, 1969. 4 p, 1 fig, 3 tab, 18 ref.

Descriptors: *Lakes, *Limnology, *Biological communities, Plankton, Bacteria, Phytoplankton, Biomass, Lake fisheries, Temperature, Summer, Winter, Reproduction.
Identifiers: *USSR, Lake Baikal, Epischura Baicalensis, SARS.

Life cycle and reproduction of Epischura Baicalensis Sars was investigated on the basis of collecting zooplankton in Lake Baikal from depths ranging from the surface to 1,400 m during the 1957-1963 period. There is no foundation for considering Epischura as a separate race. (Gabriel-USGS)
W69-07121

2I. Water in Plants

AVAILABLE AND ACCESSIBLE WATER,
Rothamsted Experimental Station, Harpenden (England).
For primary bibliographic entry see Field 02G.
W69-06984

ON THE WATER BALANCE OF GRASSLAND AND FOREST,
Commonwealth Scientific and Industrial Research Organization, Adelaide (Australia). Div. of Soils.
For primary bibliographic entry see Field 02G.
W69-06985

QUANTITATIVE MODEL OF MOISTURE FLOW IN THE PLANT-SOIL SYSTEM,
Hydrometeorological Service of the USSR (Moscow).
For primary bibliographic entry see Field 02G.
W69-06986

THE SIGNIFICANCE OF THE EXTERNAL WATER POTENTIAL AND OF SALT TRANSPORT TO WATER RELATIONS IN PLANTS,
California Univ., Riverside. Dept. of Soils and Plant Nutrition.
For primary bibliographic entry see Field 02G.
W69-06989

THE IMPORTANCE OF MASS FLOW IN THE UPTAKE OF IONS BY ROOTS FROM SOIL,
Oxford Univ. (England). Dept. of Biomathematics; and Oxford Univ. (England). Dept. of Agriculture.
F. H. C. Marriott, and P. H. Nye.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 127-134, 1968. 8 p, 2 fig, 2 tab, 11 ref.

Descriptors: *Soil-water-plant relationships, *Soil water movement, *Nutrients, Mass transfer, Solutes, Diffusion, Dispersion, Root systems, Ion transport.
Identifiers: Nutrient transport, Root growth.

Assessment of the relative contribution of mass flow and diffusion to uptake is a matter of definition, and it is less arbitrary to consider the increase in uptake caused by increase in rate of transpiration. The concentration at the root surface and the flux are estimated in terms of the transpiration rate, diffusion coefficient, root absorbing power, root radius and time, by solving a 2nd order partial differential equation numerically. An approximate simple algebraic expression due to Passiours is correct within 10% if transpiration is larger than root absorbing power, which usually holds. When it is smaller, flux increases linearly with transpiration. With increase in transpiration, the proportionate increase in flux due to mass flow, over the flux when transpiration is zero, is independent of root absorbing power. It increases markedly with decrease in moisture level, because the flux when transpiration is zero is then low. It is not greatly affected by the ion species.
W69-06991

NUTRIENT TRANSPORT TO PLANT ROOTS,
Wisconsin Univ., Madison, Dept. of Soils.
W. R. Gardner.
Trans of 9th Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 135-141, 1968. 7 p, 15 ref.

Descriptors: *Soil-water-plant relationships, *Soil water movement, *Nutrients, Mass transfer, Solutes, Diffusion, Dispersion, Root systems, Ion transport.
Identifiers: Nutrient transport, Root growth.

Transport of nutrients through soil to roots by diffusion, mass flow, and root extension is described mathematically by a partial differential equation. Complete analysis is made of transport in 1 dimension and approximate solutions are given for 2- and 3- dimensional movement. (Knapp-USGS)
W69-06992

TEMPERATURE ACCLIMATION AND OXYGEN CONSUMPTION IN PHYSA HAWNII LEA (GASTROPODA: PULMONATA),
Kansas Univ., Lawrence. Dept. of Zoology.
Janet M. Daniels, and Kenneth B. Armitage.
Hydrobiologia, Vol 33, No 1, pp 1-13, Mar 1969. 13 p, 3 fig, 3 tab, 21 ref.

Descriptors: *Acclimatization, *Temperature, *Gastropods, *Oxygen requirements, *Metabolism, Fresh water, Snails, Ecology, Statistical methods, Summer.
Identifiers: Pulmonata temperature acclimation, Oxygen consumption, Eastern Kansas ditches and parks.

A detailed study of temperature acclimation and oxygen consumption in Physa hawnii Lea (Gastropoda) of the ponds and ditches of Eastern Kansas was made. The study shows that there is no relationship between consumption and size in the size range of 10.9 to 41.6 mg; the mean oxygen consumption of snails acclimated at 5 deg, 10 deg, 20 deg, and 25 deg C increases at successfully higher temperatures and animals acclimated at 20 deg and 25 deg evidence a plateau effect at intermediate temperature ranges; there is a significant temperature effect on oxygen consumption; Q sub 10 is higher at low temperature, where Q sub 10 is a metabolic parameter; and P hawnii achieves some degree of temperature independence by acclimation and by change in activity. (Gabriel-USGS)
W69-07095

AN ECOLOGICAL STUDY OF THE ALGAE OF THE RIVER MOOSI, HYDERABAD (INDIA) WITH SPECIAL REFERENCE TO WATER POLLUTION - 1. PHYSICO-CHEMICAL COMPLEXES,
Osmania Univ., Hyderabad, (India). Dept. of Botany.
For primary bibliographic entry see Field 05B.
W69-07096

CONSUMPTION OF WATER BY PLANTS DEPENDING ON THE NEGATIVE PRESSURE OF THE SOIL WATER,
Akademiya Nauk SSSR. Laboratoriya Lesovedeniya.
N. A. Vznuzdaev.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 109-116, 1968. 8 p, 3 fig, 8 ref.

Descriptors: *Soil-water-plant relationships, *Drying, *Transpiration, *Negative pressure, Wilting, Field capacity, Moisture content, Moisture stress, Soil moisture, Soil moisture movement, Arid lands, Pine trees, Oak trees, Consumptive use.
Identifiers: Negative soil water pressure.

Pot experiments with saplings of pine, oak and elm showed that transpiration rate in the interval of soil water pressure from -0.3 to -2.5 atmospheres (zero pressure gradient) was determined by air temperature and humidity. At a soil water pressure less than -2.5 atmospheres, transpiration decreased sharply and became inversely proportioned to soil water pressure, irrespective of environment. The suction forces of roots and leaves are directly related. Neither moisture characteristics of the two soils used nor the species of the trees appeared to have any appreciable affect on this relationship. Plants died when pressure was less than -44 atmospheres. Water deficiency was clearly revealed in changes in the morphology and anatomy of roots, physiologically active in absorption of water.
W69-07136

2J. Erosion and Sedimentation

INTERSTITIAL BRINES IN PLAYA SEDIMENTS,
Geological Survey, Washington, D. C.; Geological Survey, Carson City, Nev.; and Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02K.
W69-06962

COASTAL DUNE STRUCTURES FROM PARANA (BRAZIL),
Parana Univ., Curitiba (Brazil). Geological Inst.
Joao Jose Bigarella, Rosemarie D. Becker, and Gerusa M. Duarte.
Marine Geol, Vol 7, No 1, pp 5-55, Feb 1969. 51 p, 32 fig, 4 tab, 25 ref.

Descriptors: *Dunes, *Coasts, *Sedimentary structures, Sedimentation, Winds, Movement, Provenance, Beds, Stratification, Sands.
Identifiers: *Brazil, Cross-bedding.

In the coastal plain of Parana, vertical sections, both parallel to and transverse to the average wind direction, were dug and cut through dunes. These were compared with the ones presented by the older sand ridge dunes from the Parana coastal plain. The structures of the sand ridge dunes were compared also with those from other types of dunes described by McKee (1966) from the White Sands National Monument (New Mexico) and from the Libyan Desert. The analysis of cross-bedding indicates many common features between the dunes studied by McKee and those from the Parana coastal plain, including high-angle foresets, 30 deg to 36 deg, the almost horizontal character of many bounding surfaces, thinner and flatter individual sets of cross-stratification near the tops of vertical sections, dominant tabular planar sets, and many sets of simple and trough type of cross-stratification. Especially characteristic of the coastal dunes are the convex-upward foresets, located in the upper part of the dune's brink where high-angle slipface strata occur. They result mostly from slumping. The cross-strata dip resultant vector for the whole dune coincides with the average wind direction. (Knapp-USGS)
W69-06965

NORTHWESTERN AFRICAN CONTINENTAL SHELF SEDIMENTS,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
Robert L. McMaster, and Thomas P. Lachance.
Studies supported by contract with Office of Naval Research. Nonr 396 (08) ONR. Marine Geol, Vol 7, No 1, pp 57-67, Feb 1969. 11 p, 5 fig, 11 ref.

Descriptors: *Sedimentation, *Stratigraphy, *Coastal plains, Continental shelf, Sands, Silts, Clays, Erosion, Provenance, Marine Geology, Sediment transport, Stratification, Carbonates.
Identifiers: *Africa, Sedimentary facies.

An investigation of the gravel, sand, silt, and clay components and carbonate content of the bottom surface sediments on the northwestern African shelf and upper slope reveals that sand, composed of biogenic material, quartz, and glauconite, is the most common sediment type. This sand is primarily of biogenic origin between Ifni and Cape Blanc (21 deg N) and immediately south of Cape Verde (15 deg N) whereas the wide Guinea shelf is covered with low carbonate quartz sand. Glauconite is common on the outer shelf and upper slope. Modern mid-shelf slit facies occur immediately south of the Strait of Gibraltar, on the south side of Cape Ghir (30 deg N), between the Gambia and Geba Rivers, and along the narrow Sierra Leone-Liberian shelf. Generally, illite, kaolinite, and montmorillonite are present in these facies with kaolinite predominant in the tropical areas. Modern mid-shelf facies are found where the shelf is narrow and the sediment supply is ample. Apparently bottom turbulence and current action are not sufficient to keep the outer shelf free of fine sediment accumulation. Where the shelf is wide, modern fine sediments are being deposited in estuaries and on the inner shelf. Also, a calcareous sediment type is found where the shelf has been tectonically stable and the sediment supply inadequate. Finally, carbonate values, less than 50%, OCCUR WHERE A MODERN SHELF FACIES IS BEING DEPOSITED OR WHERE CLASTIC SEDIMENTS WERE DISTRIBUTED DURING Pleistocene low sea levels.
W69-06966

OFFSHORE SEDIMENTS AND VALLEYS OF THE ORANGE RIVER (SOUTH AND SOUTHWEST AFRICA),
Georgia Univ., Sapelo Island. Marine Inst.; Georgia Univ., Athens. Dept. of Geology; Millersville State Coll., Pa.; and Ocean Science and Engineering, Inc., Washington, D. C.
John H. Hoyt, B. L. Oostdam, and David D. Smith.
Marine Geol, Vol 7, No 1, pp 69-84, Feb 1969. 16 p, 9 fig, 1 tab, 20 ref.

Descriptors: *Sedimentation, *Rivers, *Channels, *Deposition (Sediments), Deltas, Erosion, Marine Geology, Sediment yield, Silting, Streams, Clays, Coastal plains, Coasts, Currents (Water), Waves (Water).
Identifiers: *South Africa, Submarine valleys.

Detailed 'sparker' surveys of the inner continental shelf off the Orange River, the major drainage of southern Africa, defined a large sediment lens and 2 buried offshore extensions of the bedrock valley. Intermixed river and shelf sediments form a body that is air-foil shaped in plan with trailing edge down-current (northwest). This body extends seaward 16 mi and laterally about 70 mi, has a maximum thickness 6 mi offshore of more than 200 ft, and a volume of approximately 9 cu mi. The sediment surface slopes 10 ft/mi out to 100 ft depths and then steepens to 30-40 ft/mi to 400 ft below sea level. Most sediments appear to be fine sands, silts and clays of probable Late Pleistocene-Holocene age. At the coastline, 2 submarine valley floors are about 150 and 200 ft below sea level and are cut as much as 150 ft into the bedrock platform. Since the slope of the valley floors (20 ft/mi) is not as steep as that of the bedrock platform (50 ft/mi) the valleys intersect the platform surface at depths of about 250 and 300 ft, suggesting 2 or more emergences to approximately those levels. Absence of a subaerial delta results from intensive wave attack by the obliquely impinging South Atlantic swells, which cause a highly effective longshore sediment transport system.
W69-06967

X-RAY ANALYSES OF CLAY MINERALS IN SOME RECENT FLUVIATILE SEDIMENTS ALONG THE COASTS OF CENTRAL ITALY,
Amsterdam Univ., (Netherlands).
J. Quakernaat.
Amsterdam Univ Physico-Geogr Lab Publication No 12, 1968. 105 p, 67 fig, 10 tab, 90 ref, 4 append.

Descriptors: *Clay minerals, *Sedimentary petrology, *X-Ray spectroscopy, *Sedimentation, Sampling, Potassium, Calcium, Magnesium, Chemical analysis, Cation exchange, Water analysis, River flow, Estuaries.
Identifiers: *Central Italy, *Fluviatile sediments.

Distribution of clay minerals in recent fluviatile sediments in the estuaries of several Italian rivers was investigated by using 73 samples from 52 rivers and utilizing a Guinier-de Wolff X-ray camera and an X-ray diffractometer. The qualitative and quantitative results of the study show that 4 clay mineral provinces can be identified along the coasts of central Italy characterized as follows: (1) rivers carrying 60 to 70% of illite and irregular illite-chlorite interstratification; (2) rivers carrying 20 to 50% of illite and irregular smectite-chlorite interstratification; (3) rivers transporting 20 to 40% of high-charge smectite and small amount of kandite; and (4) the river sediments containing high-charge vermiculate and smectite (30 to 40%), 20 to 40% of illite, and 10% of kandite. (Gabriel-USGS)
W69-07009

MODEL STUDY OF HYDRAULIC PHENOMENA ASSOCIATED WITH RIVER BED EROSION AROUND A BRIDGE PIER (POLISH),
Warsaw Engineering Coll., (Poland).
Andrzej Szuster.
Arch Hydrotech, Vol 15, No 4, Warsaw, pp 571-586, 1968. 16 p, 10 fig, 5 ref.

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Descriptors: *Model studies, *River bed, *Erosion, *Piers, Bridge design, Hydraulic models, Runoff, Streamflow, Currents (Water), Floods, River basin development, Velocity, Water level fluctuations, Mathematical studies.
Identifiers: *Poland, River bed erosion.

Hydraulic phenomena taking place around bridge piers were investigated analytically and experimentally by using piers of various forms and dimensions. Experiments were particularly concerned with the identification of water streamflow patterns around the models, the distribution of stream vertical velocities, and water level fluctuations around the pier models. The study shows that a diamond-shaped pier is associated with the minimum amount of river bed erosion. (Gabriel-USGS)
W69-07011

THE TIDAL ORIGIN OF SOME VERTICAL SEDIMENTARY CHANGES IN EPICONTINENTAL SEAS,
National Inst. of Oceanography, Wormley (England).
M. A. Johnson, and R. H. Belderson.
J. Geol, Vol 77, No 3, pp 353-357, May 1969. 5 p, 8 ref.

Descriptors: *Sedimentation, *Stratification, *Tides, *Currents (Water), Erosion, Deposition (Sediments), Channels, Deltas, Sedimentary structures, Sediment transport, Bed load, Bottom sediments, Tidal effects, Sea level.
Identifiers: Tidal Currents, Sea level changes.

Vertical changes in grain size and sedimantary structure of shallow sediment deposits and sedimentary rocks are a function of tidal-current action as well as water depth and distance from shore. Tidal current strength depends upon the tidal regime of the whole sea and upon many local factors, some of which may change more rapidly than water depth. Tidal current changes will also occur with any depth changes, and the sedimentary record will preserve the results of both. It is not safe to ascribe sedimentary changes to depth changes alone. Examples of major changes in tidal current patterns with insignificant depth changes include the opening of Dover straits and the opening of the Irish Sea. Smaller tidal current changes may be caused by rapid delta formation, shoreline retreat, sedimentation in tidal channels, and the effect of engineering structures such as dams and Jetties. (Knapp-USGS)
W69-07087

FRACTIONATION OF PHOSPHORUS IN LAKE SEDIMENTS: ANALYTICAL EVALUATION,
Connecticut Agricultural Experiment Station, New Haven.
For primary bibliographic entry see Field 02H.
W69-07093

GERMANIUM IN RECENT SEDIMENTS OF THE BLACK SEA (RUSSIAN),
Akademiya Nauk SSSR. Institut Okeanologii.
V. S. Sokolov, and M. F. Pilipchuk.
Dokl Akad Nauk USSR, Vol 185, No 3, pp 679-682, 1969. 4 p, 2 fig, 1 tab, 17 ref.

Descriptors: *Tracers, *Metals, *Marine geology, Sediments, Precipitable water, Mud, Carbonates, Organic matter, Geochemistry, Erosion, Sands, Clays, Limestones, Sulfides, Abrasion.
Identifiers: Black Sea germanium-bearing sediments.

Distribution and content of germanium in the recent sediments of the Black Sea was investigated by using a standard colorimetric method. The study shows that germanium is characterized by a relatively poor geochemical mobility during the sedimentation process; however its mobile forms are transported into the Black Sea in a soluble state. The distribution of germanium in the recent sediments of the Black Sea shows that the highest Ge concentrations are observed in the marginal parts of the basin, as a result of considerable amount of clastic material due to the abrasion of coastal rocks. (Gabriel-USGS)
W69-07120

WHERE MOST GRAINS OF VERY COARSE SAND AND FINE GRAVEL ARE DEPOSITED,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
Richard J. Russell.
Sedimentology, Vol 11, No 1-2, pp 31-38, Oct 1968. 8 p, 1 fig, 2 tab, 19 ref. Contract Nos Nonr 35 608, 388 002 and Nonr 1575 (03), 388 002.

Descriptors: *Sedimentation, *Sediments, *Particle size, Erosion, Sediment transport, Flow, Sediment yield, Sedimentology, Sediment discharge.
Identifiers: Particle entrainment.

Although supplied to rivers, grains of about 1-6 mm diameters are notably deficient in fluvial deposits because they are more readily entrained and more rapidly transported than grains of larger or smaller size. Very coarse sand and fine gravel are rarely found in shallow-water sediments for the same reason. Currents, mainly of wave origin, concentrate these grains in beaches, where they are present in more-than-ordinary abundance.
W69-07128

SUSPENDED LOAD IN THE RIO DE LA PLATA DRAINAGE BASIN,
Instituto Nacional de Limnologia, Santo Tome (Argentina); and Scripps Institution of Oceanography, La Jolla, Calif.
P. J. Depetris, and J. J. Griffin.
Sedimentology, Vol 11, No 1-2, pp 53-60, Oct 1968. 8 p, 2 fig, 4 tab, 9 ref.

Descriptors: *Sedimentology, *Provenance, *Erosion, Streamflow, Clays, Silts, Sediment yield, Sediment transport, Mineralogy.
Identifiers: Rio de la Plata (Argentina).

The Rio de la Plata Drainage Basin is the second largest in South America, with more than 75% of its discharge provided by the Parana River and the remainder by the Uruguay River. Erosion rates, and silt- and clay-size mineralogy indicate that most of the basin loads are provided by the mountainous environment-type.
W69-07129

EXPERIMENTAL INVESTIGATION ON THE EROSION-SENSITIVITY OF A SAND-CLAY LAMINATION,
Ministry of Transport and Waterways, The Hague (Netherlands); and Waterloopkundig Laboratorium, Delft (Netherlands).
J. H. J. Terwindt, H. N. C. Breusers, and J. N. Svasek.
Sedimentology, Vol 11, No 1-2, pp 105-114, Oct 1968. 10 p, 5 fig, 3 tab, 15 ref.

Descriptors: *Erosion, *Estuaries, *Sediments, Sands, Silts, Turbulence, Channel erosion, Sedimentology, Shear stress, Resistance, Model studies, Hydraulic models.
Identifiers: Laminated sediments.

Laboratory tests were made of the critical shear stress and bed erosion as a function of time and bed shear stress for a sediment consisting of alternating sand and clay layers 0.1-3 cm thick. This type of deposit occurs quite frequently in estuaries and tidal inlets. The tests were carried out on an original bed deposited in an estuary. The critical shear stress and the degree of erosion in relation to time for the sand-clay lamination were found to agree in order of magnitude with those for clay layers. The resistance to erosion of the sand-clay lamination is therefore comparable with that of clay layers.
W69-07130

SOME EXPERIMENTS ON THE GENESIS OF TURBIDITY CURRENTS,
Koninklijke-Shell Exploratie en Produktie Laboratorium, Rijswijk (The Netherlands).
W. Van der Knaap, and R. Eijpe.
Sedimentology, Vol 11, No 1-2, pp 115-124, Oct 1968. 10 p, 4 fig, 1 tab, 8 ref.

Descriptors: *Model studies, *Turbidity currents, *Sediment transport, Density currents, Provenance, Slopes, Sands, Silts, Clays, Mixing, Stratification, Pore pressure, Hydraulic models, Porosity, Permeability.
Identifiers: Flume studies.

Turbidity currents are thought to be the agency responsible for the transport and deposition of the sediments known as turbidites. The way in which such currents may arise has been studied experimentally in a glass-walled tank. The starting point of the experiments was setting the sediments in motion by raising their pore pressure via a shock or vibration. This was achieved in the experiments by striking the metal bottom of the tank with a mallet. The response of a heap of homogeneous sand to such a shock was merely to change the angle of its slope. If a layer of sand was draped over a core of coarser, homogeneous sand, sliding occurred along the plane of permeability contrast and the less coarse sand was deposited at the toe of the slope. When the layer consisted of kaolin, which has a much lower permeability than sand, sliding again took place, butthe clay subsequently mixed with the water and was moved along the bottom of the tank in the manner attributed to turbidity currents. An attempt is made to set up a scaling rule for experiments of this type and the consequences that such a rule may have in subsequent study are briefly discussed.
W69-07131

FORMATION OF LARGE-SCALE TROUGH CROSS-STRATIFICATION IN A FLUVIAL ENVIRONMENT,
Adelaide Univ. (Australia). Dept. of Geology.
George E. Williams.
J Sediment Petrol, Vol 38, No 1, pp 136-140, Mar 1968. 5 p, 8 fig, 6 ref.

Descriptors: *Sedimentation, *Alluvial channels, *Ripple marks, Sand waves, Sedimentary structures, Currents (Water), Stratification.
Identifiers: Cross-bedding.

Large-scale lunate ripple marks are preserved on the dry, sandy bed of a channel crossing a piedmont plain in South Australia. Longitudinal and transverse sections through the channel bed reveal that the ripple marks have deposited typical large-scale trough cross-stratified cosets.
W69-07132

2K. Chemical Processes

A CHEMICAL INDEX OF SOIL NITROGEN AVAILABILITY,
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 05B.
W69-06860

NUTRIENT REGENERATION AND PREFORMED NUTRIENTS OFF OREGON,
Kilho Park.
Limnology and Oceanography, Vol 12, No 2, pp 353-357, April 1967. 3 fig, 10 ref.

Descriptors: *Cycling nutrients, *Nutrients, *Oregon, Nitrates, Phosphates, Silicates, Oceanography.
Identifiers: *Chemical oceanography, Preformed nutrients, Nutrient ratios.

Vertical distribution of nitrate, phosphate and silicate off the Oregon coast is presented. Measured nitrate and phosphate are divided into two fractions: (1) nutrients of oxidative origins that have

been regenerated from organic matter, and (2) preformed nutrients that were present as such in the water at the time it sank from the surface. The ratios in the biochemical changes in oxygen:nitrogen:phosphorus are 138:16:1, and phosphorus are 7:1. This preformed nutrient ratio might be used to trace the water to its origin. The report also describes vertical nutrient regeneration off the Oregon coast. (Konrad-Wis)
W69-06862

GEOCHEMISTRY OF SUBSURFACE BRINES.
Kansas Univ., Lawrence. Dept. of Civil Engineering; Kansas State Geological Survey, Lawrence; and Louisiana State Univ., Baton Rouge. School of Geology.

E. E. Angino, and G. K. Billings (Editors). Proc of Symp on Geochem of subsurface brines, Kansas Univ, Mar 25-26, 1968. Chem Geol, Vol 4, No 1-2, Mar 1969. 371 p.

Descriptors: *Geochemistry, *Brines, *Subsurface investigations, *Subsurface flow, Groundwater movement, Water chemistry, Solutes.
Identifiers: Subsurface brines.

A symposium dealing with the subject of geochemistry of subsurface brines was held at the University of Kansas on Mar 25-26, 1968 and was sponsored by State Geological Survey of Kansas, Kansas University, and the Geochemical Society of America. The symposium served 3 purposes; it gives evidence that the chemistry of subsurface brines is still in what could be called 'state of art stage,' collects under one cover for the first time a summary of the many problems facing those working with subsurface brines, and presents a good summary of our knowledge of the chemistry of subsurface brines and the problems relative thereto. (Myers-USGS)
W69-06950

CHARACTERIZATION OF BRINES FOR ECONOMIC ANALYSIS,
Dow Chemical Co., Freeport, Tex.
For primary bibliographic entry see Field 03A.
W69-06951

SUBSURFACE BRINES AND MINERAL EQUILIBRIA,
McMaster Univ., Hamilton (Ontario). Dept. of Geology.
James R. Kramer.
Chem Geol, Vol 4, no 1-2, pp 37-50, Mar 1969. 14 p, 8 fig, 6 tab, 15 ref. Proc of Symp on Geochem of Subsurface Brines, Kansas Univ, Mar 25-26, 1968.

Descriptors: *Water chemistry, *Groundwater, *Brines, *Saline water, *Chemical properties, Equilibrium, Data processing, Digital computers, Statistical methods, Regression analysis, Aquifers, Geochemistry, Aqueous solutions.
Identifiers: *Factor analysis.

About, 2,500 brine chemical analyses were classified according to lithology of their source aquifers. Factor analysis was used to determine possible mineral equilibria. Conclusions from factor analysis are used to calculate ion products which are compared with thermodynamically derived equilibrium values. In most analyses, Cl, sulfate, Na, Ca, Mg, bicarbonate, Sr, and Ba are reported. Most waters are Na -Ca-chloride types saturated in calcium carbonate. Sulfate is an independent variable in most waters but has a weak inverse relationship to bicarbonate, a positive correlation to Mg, and sometimes is weakly inverse to Sr and Ba, suggesting an Sr-Ba-sulfate equilibrium. Ca and Mg show a stronger inverse correlation to bicarbonate in dolomite than in other rocks. Ca shows a stronger correlation with Mg in dolomite than in limestone, suggesting Ba-Sr-carbonate equilibrium. Equilibrium involving K-Mg-H-Si is suggested by data from a smaller population of more complete analyses. For main entry see W69-06950. (Knapp-USGS)
W69-06952

ION ASSOCIATION IN NATURAL BRINES,
Geological Survey, Menlo Park, Calif., and Geological Survey, Washington, D. C.
Alfred H. Truesdell, and Blair F. Jones.
Chem Geol, Vol 4, No 1-2, pp 51-62, Mar 1969. 12 p, 1 fig, 4 tab, 26 ref. Proc of Symp on Geochem of Subsurface Brines, Kansas Univ, Mar 25-26, 1968.

Descriptors: *Water chemistry, *Ions, *Brines, *Saline water, *Equilibrium, Chemical potential, Chemical reactions, Thermodynamics, Electrical conductance, Aqueous solutions.
Identifiers: *Activity coefficients.

Natural brines, both surface and subsurfaces, are highly associated aqueous solutions. Ion complexes in brines may be ion pairs in which the cation remains fully hydrated and the bond between the ions is essentially electrostatic, or coordination complexes in which one or more of the hydration water molecules are replaced by covalent bonds to the anion. Except f . Cl, the major simple ions in natural brines form ion pairs; trace and minor metals in brines form mainly coordination complexes. Limitations of the Debye-Huckel relations and lack of data on definition and stability of all associated species in concentrated solutions tend to produce underestimates of the degree of ion association, except where the brines contain a very high proportion of Cl. Data and calculations on closed basin brines of highly varied composition and electrode measurements of single-ion activities emphasize the role of magnesium complexes. Alkaline sulfo- or chloro-carbonate brines (western Great Basin) carry significant trace metal contents apparently as hydroxides or hydroxy polyions. Neutral high chloride brines (Bonneville Basin) are generally deficient in trace metals. Many brine-mineral equilibria, particularly for high-density brines, may be studied thermodynamically. For main entry see W69-06950. (USGS)
W69-06953

GEOCHEMISTRY OF PORE WATERS FROM SHELL OIL COMPANY DRILL HOLES ON THE CONTINENTAL SLOPE OF THE NORTHERN GULF OF MEXICO,
Geological Survey, Woods Hole, Mass.; and Woods Hole Oceanographic Institution, Mass.
F. T. Manheim, and J. L. Bischoff.
Chem Geol, Vol 4, No 1-2, pp 63-82, Mar 1969. 20 p, 9 fig, 5 tab, 26 ref. Proc of Symp on Geochem of Subsurface Brines, Kansas Univ, Mar 25-26, 1968.

Descriptors: *Water chemistry, *Groundwater, *Drill holes, *Brines, Salts, Chemical reactions, Equilibrium, Aqueous solutions, Ion transport, Diffusion, Chemical precipitation, Geochemistry, Continental slope, Salinity.
Identifiers: *Pore waters, Salt domes.

Pore waters were analyzed from 6 holes drilled in water depths of 600-3,000 ft, penetrating up to 1,000 ft of Pliocene-Recent clayey sediments. Salt and anhydrite caprock were encountered in one diapiric structure on the continental slope. Samples from holes drilled near diapiric structures showed systematic increases of pore-water salinity with depth, suggestive of salt diffusion from underlying salt plugs. Anomalous concentrations of K and Br indicate that at least 1 plug contains late-stage evaporate minerals. Salinities approaching halite saturation were observed. Samples from holes away from diapiric structures showed little change in pore-water chemistry, except for loss of sulfate and other variations attributable to early-stage diagenetic reactions with enclosing sediments. Thus, increased salt concentrations in even shallow sediments from this part of the Gulf appear to provide an indicator of salt masses at depth. For main entry see W69-06950. (USGS)
W69-06954

ON THE EVOLUTION OF SUBSURFACE BRINES IN ISRAEL,
Hebrew Univ., Jerusalem (Israel). Dept. of Geology.
Y. K. Bentor.
Chem Geol, Vol 4, No 1-2, pp 83-110, Mar 1969. 28 p, 20 fig, 2 tab, 14 ref, 1 append. Proc of Symp on Geochem of Subsurface Brines, Kansas Univ, Mar 25-26, 1968.

Descriptors: *Water chemistry, *Groundwater, *Brines, Classification, Evaporation, Equilibrium, Geochemistry, Salts, Saline water, Aqueous solutions.
Identifiers: *Israel, Dead Sea Rift Valley.

Subsurface brines occur in Israel at depths of 1,000-3,400 m in Early Cambrian-Early Cretaceous formations. Some are identical in composition and salinity with present-day ocean water, except for higher Ca and lower Mg content, a change attributed to dolomitization. The oilfield waters in Early Cretaceous formations of the coastal plain are still similar to ocean water, but 2 to 3 times more saline; they have lost most of their sulphates and are enriched in Br and I, both derived from organic sources. In brines from Jurassic to Early Cambrian sources, salinities as well as the Ca/Na and Br/I ratios increase progressively with depth while the Na/K, bicarbonate/Cl and Cl/Br ratios decrease. It is assumed that the lowermost Paleozoic brines formed by surface evaporation during Infracambrian to Early Cambrian time and were later modified by differential ultrafilitration. Highly saline brines at the depth in the Rift Valley are chemically similar to the Early Paleozoic brines, but even more differentiated. Some show salinities of around 300,000 ppm, a Na/K-value of 1-2 and extremely high Ca concentrations. These waters are believed to be old Paleozoic brines that have undergone a new cycle of surface concentration in Pleistocene Rift Valley lakes, the precursors of the Dead Sea. (For main entry see W69-06950)
W69-06955

WATER HISTORY OF CRETACEOUS AQUIFERS, EAST TEXAS BASIN,
Albion Coll., Mich.
John W. Parker.
Chem Geol, Vol 4, No 1-2, pp 111-133, Mar 1969. 23 p, 22 fig, 16 ref. Proc of Symp on Geochem of Subsurface Brines, Kansas Univ, Mar 25-26, 1968.

Descriptors: *Water chemistry, *Groundwater, *Brines, *Saline water, *Texas, *Aquifers, Geochemistry, Thermal water, Aqueous solutions, Saline water intrusion, Saline water systems, Solutes, Ions, Chemical reactions, Connate water, Groundwater basins.
Identifiers: *East Texas Basin, Cretaceous aquifers.

Circumstantial evidence of the history of water in 5 Cretaceous aquifers is supplied by water analyses comparisons and a study of the ratios of the major ions, Ca, Mg, Na, Cl, sulfate and bicarbonate. Water from each aquifer has distinctive characteristics, but there are interconnections, especially near the Mexia-Talco fault zone and at an unconformity that extends across the Sabine uplift. Some piercement salt domes modify formation waters, but most salt domes have little or no noticeable effect. Apparently clay sheaths protect the salt columns from solution. Town water supplies on the north Texas shelf are affected by invasion of hot brine from the Tyler Basin, moving from east to west through the Woodbine Sandstone. Ion ratio comparisons show that waters in the older, more deeply buried aquifers have been modified more (compared with present-day sea water) than that in younger, less deeply buried aquifers. Ion ratio maps show the effect of time and rock compositions upon the relative kind and amount of dissolved solids in the water, due to reactions with minerals and organic material in the rocks. (For main entry see W69-06950.)
W69-06956

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GEOCHEMISTRY OF SALINE SUBSURFACE WATER, SALINE COUNTY (MISSOURI),
Missouri Univ., Columbia, Dept. of Geology.
Alden B. Carpenter, and John C. Miller.
Proc of Symp on Geochem of Subsurface Brines, Kansas Univ, Mar 25-26, 1968. OWRR Proj No B-002-MO. Chem Geol, Vol 4, No 1-2, pp 135-167, Mar 1969. 33 p, 22 fig, 11 tab, 32 ref.

Descriptors: *Water chemistry, *Groundwater, *Brines, *Saline water, *Missouri, Equilibrium, Statistical methods, Aqueous solutions, Saline water systems, Aquifers, Limestones, Dolomites, Geochemistry, Connate water, Solutes, Ions, Clays, Ion Exchange.
Identifiers: *Saline County (Missouri).

Saline subsurface water quality in central Missouri is largely governed by mineralogy. Although the water is supersaturated with respect to quartz, the silica concentration is held constant, apparently by the dissolution of illite. A series of scatter diagrams for the water indicates that potassium and hydrogen ion have a markedly different relationship to variations in salinity than do other group Ia elements. The K /H activity ratio is apparently controlled by the presence of illite or illite plus kaolinite. Calculation of ion activity products indicates that the saline water is approximately saturated with respect to calcite and dolomite. The mean Ca /Mg activity ratio, 1.51, is reasonable for water from dolomite limestones. The variations in the Ca/Na and Mg/Na ratios in the Missouri water samples can be predicted using a model in which the concentration of Na is affected only by the addition or removal of water from the system whereas the concentrations of Ca and Mg are additionally affected by equilibration with calcite and dolomite. The ion activity products for Sr and Ba carbonates suggest saturation and that the Sr/Ba activity ratio is mineralogically controlled. Because the chemistry of the saline water is now controlled to a large extent by its mineralogical environment the compositional characteristics of the water cannot be used to determine the origin of the salinity. (For main entry see W69-06950.)
W69-06957

CHEMISTRY OF SOME ANADARKO BASIN BRINES CONTAINING HIGH CONCENTRATION OF IODIDE,
Bureau of Mines, Bartlesville. Okla. Bartlesville Petroleum Research Center.
A. Gene Collins.
Proc of Symp on Geochem of Subsurface Brines, Kansas Univ, Mar 25-26, 1968. Chem Geol, Vol 4, No 1-2, pp 169-187, Mar 1969. 19 p, 10 fig, 5 tab, 51 ref.

Descriptors: *Water chemistry, *Groundwater, *Brines, *Oklahoma, Groundwater basins, Geochemistry, Chemical reactions, Equilibrium, Aqueous solutions, Saline water, Saline water systems, Aquifers, Connate water, Solutes, Ions, Diagenesis.
Identifiers: *Anadarko Basin (Okla), Iodide concentrations.

A study was made to determine the geochemical relationships between the subsurface fluids and some of the geologic strata in the Anadarko Basin, Oklahoma. Samples of brines, cores, and petroleums from Pennsylvanian and Mississippian age sediments were analyzed. The brine samples from Mississippian and Pennsylvanian age sediments in the northern Oklahoma Platform area contain the highest concentration of iodide ever recorded. The brines, a Na-Ca-Cl type, probably have undergone diageneses such as dolomitization. The Br concentrations of these brines indicate that they probably are relict. Some of the brines were in equilibria with sandstones, some with dolomites, and some with limestones. Compared to sea water concentrated by solar evaporation, most of these brines are enriched in Br, Ca, Li, Sr, and I, and depleted in Mg, and K. Most of the brines from Mississippian age sediments are enriched in B, and most from Pennsylvanian age sediments were depleted in B. The high concentrations of I in these brines is attributed to concentration by shallow water fauna and flora, preserved by rapid sedimentation. Additional concentration of I in these brines occurred during diagenesis. (For main entry see W69-06950.)
W69-06958

MINOR ELEMENTS IN OIL-FIELD WATERS,
Shell Develop Co., Houston, Tex.; Du Pont de Nemours (E. I.) and Co., Wilmington, Del.; and Perkin-Elmer Co, Silver Spring, Md.
Gordon Rittenhous, Robert B. Fulton, III, Robert J. Grabowski, and Joseph L. Bernard.
Proc of Symp on Geochem of Subsurface Brines, Kansas Univ, Mar 25-26, 1968. Chem Geol, Vol 4, No 1-2, pp 189-209, Mar 1969. 21 p, 8 fig, 5 tab, 31 ref.

Descriptors: *Geochemistry, *Groundwater, *Oilfields, *Trace lements, Aqueous solutions, Equilibrium, Chemical reactions, Solutes, Ions, Ion exchange, Saline water, Connate water, Spectroscopy.
Identifiers: *Oil-field waters, Minor elements.

The minor element composition of 823 oil-field water samples from the United States and Canada was determined spectrochemically. In these samples the determined concentrations have a wide range but commonly are K and Sr, over 100 ppm; Al, B, Ba, Fe, Li, and Si, 1.0-100 ppm; Cr, Cu, Mn, Ni, Sn, Ti, and Zr in the ppb range in most waters; and Be, Co, Pb, V, W, and Zn, in the ppb range in some waters. When differences in total dissolved solid contents are eliminated by calculation, Cr, Li, Mn, Si, and Sr are commonly more than twice as abundant as in present sea water; Cu, K, Ni, and Sn are commonly less than half as abundant. Si content appears to vary between areas, between formations in the same area, and inversely with total solids content in the same formation. Relationships in the variation of other minor elements is more difficult to establish, partly because the minor elements, if actually present, were below detection limits and partly because spectrochemical method was not of high precision. Extensive changes in pH of many waters occurred between collection and analysis. Because of this and changes that may occur between subsurfaces and surface, quantitative interpretation of geochemical relationships between water and rock composition will be difficult. (For main entry see W69-06950.)
W69-06959

GEOCHEMISTRY AND ORIGIN OF FORMATION WATERS IN THE WESTERN CANADA SEDIMENTARY BASIN, 2. ALKALI METALS,
Louisiana State Univ., Baton Rouge; Research Council of Alberta, Edmonton; and Alberta Oil and Gas Conservation Board, Edmonton.
Gale K. Billings, Brian Hitchon, and D. R. Brian.
Proc of Symp on Geochem of Subsurface Brines, Kansas Univ, Mar 25-26, 1968. Chem Geol, Vol 4, No 1-2, pp 211-223, Mar 1969. 13 p, 5 fig, 2 tab, 22 ref.

Descriptors: *Geochemistry, *Water chemistry, *Groundwater, *Alkali metals, Groundwater basins, Solutes, Potassium, Sodium, Ion exchange, Membrane processes, Clays, Filtration, Connate water, Chemical reactions.
Identifiers: *Canada, Western Canada sedimentary basin, Lithium, Rubidium.

The population statistics for Cl, Br, I, bicarbonate, sulfate, Na, Ca, Mg, K, Rb, Li, Sr, Mn, Zn, Fe, Ni, Co, Cr and Cu in formation waters from the western Canada sedimentary basin are presented, together with weighted mean composition. Five types of formation waters are present in the basin but only 2 are considered in detail: (1) a membrane-concentrated formation water; and (2) a formation water formed either by mixture of 1 and very small amounts of bitterns resulting from halite precipitation or by hyperfiltration. Investigation of the alkali metals indicates that the membrane is selective and leads to a pattern of relative concentration in the decreasing order: Rb; K; Na; Li. The movement of alkalies through the filter is primarily by sitehopping and the relative rate is controlled by the ion's ease of replacibility in the decreasing order: Li; Na; K; Rb. The composition, and thus ion-ratios, are set by mineral-solution reactions, particularly during early diagenesis. Modification of the composition then occurs by selective filtration, further chemical reaction, and mixing during the subsequent fluid migration resulting from hydrodynamic drive. (For main entry see W69-06950.)
W69-06960

SOME CHEMICAL ALTERATIONS OF SUBSURFACE WATERS DURING DIAGENESIS,
University of Southern California, Los Angeles. Dept. of Petroleum Engineering.
George V. Chilingarian, and Herman H. Rieke.
Proc of Symp on Geochem of Subsurface Brines, Kansas Univ, Mar 25-26, 1968. Chem Geol, Vol 4, No 1-2, pp 235-252, Mar 1969. 18 p, 8 fig, 9 tab, 38 ref.

Descriptors: *Geochemistry, *Diagenesis, *Connate water, *Subsurface waters, Saline water, Brines, Oil fields, Solutes, Sea water, Chemical reactions, Equilibrium, Membrane processes, Ion exchange, Filtration, Compaction, Organic compounds.
Identifiers: *Oil-field brines, Pore waters, Oxygen isotopes.

Pore waters in most of the petroliferous sedimentary basins may ultimately be derived from the sea. There is a striking similarity between the amino-acid spectra in the fossil brines and in present-day sea water. Similarities in solutes also point in this direction, yet systematic chemical differences exist between the ancient and modern connate waters. The changes may be caused by a variety of processes and mechanisms such as dissolution and precipitation, pH-Eh variations, microbial activities, base exchange, chemisorption, and dolomitization. The similarity between isotope characteristics of the oil-field brines and present-day sea water suggests that in many cases concentration has not been accomplished by syngenetic evaporation, but probably occurred as a result of compaction and ion filtration by charged-net clay membranes. Experimental results indicate that the mineralization of squeezed-out solutions progressively decreases with increasing overburden pressure, but in moving vertically through a thick shale sequence, could increase to levels found in oil-field brines; the Ca/Cl and Ca/Na ratios could, but not necessarily, also increase. The mineralization of interstitial solutions in shales should be less than that in associated sandstones. If water moves from a sandstone bed through a clay layer into another sandstone bed, the water in the latter bed may be less mineralized because of filtration through a charged-net clay membrane. (For main entry see W69-06950.)
W69-06961

INTERSTITIAL BRINES IN PLAYA SEDIMENTS,
Geological Survey, Washington, D. C.; Geological Survey, Carson City, Nev.; and Geological Survey, Menlo Park, Calif.
Blair F. Jones, A. S. Vandenburgh, A. H. Truesdell, and S. L. Rettig.
Proc of Symp on Geochem of Subsurface Brines, Kansas Univ, Mar 25-26, 1968. Chem Geol, Vol 4, No 1-2, pp 253-262, Mar 1969. 10 p, 4 fig, 1 tab, 11 ref.

Descriptors: *Water chemistry, *Brines, *Playas, Evaporation, Saline lakes, Saline water, Saline water systems, Chemical precipitation, Equilibrium, Solutes, Aqueous solutions, Lakes, Great Basin, Clays, Groundwater, Ion exchange.
Identifiers: *Playa sediments, Western U.S.

In many closed drainages in the Great Basin, the interstitial solutions of shallow, fine-grained playa deposits store a large quantity of dissolved solids and are often more concentrated than associated lakes and ponds. These interstitial fluids commonly have a distinctive ionic composition which sometimes cannot be explained by either simple mixing of surface and subsurface inflow or by evaporative concentration. At Abert Lake, Oregon, the interstitial solute concentrations increase with depth to values as much as 5 times greater than the lake. Where Na, Cl, and carbonate species constitute more than 90% of the solutes, Na/Cl ratios in the lake water are lower than in the lake bottom sediments and higher than in playa fluids, and Na/K ratios are highest in the fluids of lake bottom muds and lowest in playa fluids. In deeper playa profiles, interstitial Na/Cl tended to decrease with depth (5 ft maximum). Na/Cl ratios are indicative of total carbon dioxide in solution and the effects of organic decay in surficial sediments. These ratios, coupled with data on silica and bulk density, show that higher carbon dioxide content accompanying decay promotes silicate dissolution and hydrogen ion exchange, stripping alkalis from sediment which had preferentially absorbed K when entering the lake. On subsequent loss of pore fluid in the playa regime, silica initially released to solution in the lake environment is readsorbed on dissolution products. For main entry see W69-06950 (USGS)
W69-06962

GEOCHEMISTRY AND HYDRODYNAMICS OF THE PARADOX BASIN REGION, UTAH, COLORADO AND NEW MEXICO,
Geological Survey, Washington, D. C.; and Petroleum Research Corp., Denver, Colo.
Bruce B. Hanshaw, and Gilman A. Hill.
Proc of Symp on Geochem of Subsurface Brines, Kansas Univ, Mar 25-26, 1968. Chem Geol, Vol 4, No 1-2, pp 263-294, Mar 1969. 32 p, 9 fig, 3 tab, 29 ref.

Descriptors: *Water chemistry, *Hydrodynamics, *Saline water systems, *Groundwater basins, *Southwest U.S., Chemical reactions, Equilibrium, Ions, Solutes, Ion exchange, Membrane processes, Osmosis, Filtration, Groundwater movement, Aquifers, Aquicludes, Clays, Shales, Recharge, Potentiometric level.
Identifiers: Paradox Basin (Utah-Colo-N.M.).

The water chemistry and groundwater movement of the Paradox Basin in the 4 corners region of SW United States was studied using drill-stem-test samples and pressure charts. The direction of groundwater movement in all units studied in the Paradox Basin is principally southwestward. Sodium chloride type water predominates in Permian and pre-Permian rocks although Ca and Mg are commonly high in some areas. In places where the groundwater has less than 10,000 mg/l total dissolved solids, sulfate generally becomes important. A combination of chemical and hydrologic data indicates that the east flank of the Monument uplift is faulted at depth. East of the uplift, groundwater from Paleozoic aquifers is generally briny, about 35,000 mg/l whereas west of the uplift, groundwater from these aquifers is commonly fresh to slightly saline, about 10,000 mg/l. This pattern indicates a restriction of flow from west to east in the area of the uplift; the regional flow trend is diverted southward by the fault barrier at depth. Previous hydrologic and geochemical study of the San Juan Basin shows the existence of an osmotic flow system within Cretaceous strata. Jurassic horizons were assumed to be the outflow receptors of the membrane system. However, the known occurrence of briny groundwater in Pennsylvania and Mississippiam aquifers coupled with the high potentio-metric surfaces of these same units leads to the postulate that they, not the Jurassic, may be the outflow receptors for the entire membrane system. For main entry see W69-06950. (USGS)
W69-06963

RELATIVE FACTORS INFLUENCING MEMBRANE FILTRATION EFFECTS IN GEOLOGIC ENVIRONMENTS,
California Univ., Berkeley. Dept. of Geology and Geophysics.
Frederick A. F. Berry.
Proc of Symp on Geochem of Subsurface Brines, Kansas Univ, Mar 25-26, 1968. Grant No GA-1371 (NSF). Chem Geol, Vol 4, No 1-2, pp 295-301, Mar 1969. 7 p, 52 ref.

Descriptors: *Water chemistry, *Membrane processes, *Clays, *Shales, Osmosis, Adsorption, Ion exchange, Connate water, Saline water, Brines, Geochemistry, Filtration.
Identifiers: *Hyperfiltration, Kerogen.

The membrane properties of shales are caused by the electrical charge properties of their constituent clay minerals and organic matter. The clay minerals are cation exchangers at singly-charged sites and have a small anion exchange capacity by replacement of hydroxide ion. Kerogen is the main organic constituent, and may be as much as 2% by weight of shales. It is composed mainly of denatured humic acids which have cation exchange capacity in the carboxyl and hydroxyl groups. Amino acids have anion exchange capacity. Rates of passage of ions through shale membranes are determined by availability of ions, dissociation, non-ionic adsorption, relative adsorption of divalent and monovalent cations, and mass effects. Dissociation effects are probably the most important; the more highly associated species pass most readily. Common clays adsorb divalent cations in preference to monovalent species. Ions are preferentially adsorbed when differences of solute ionic potential and exchange-site ionic potential are minimum; Na should be hyperfiltrated preferentially to Li and Sr with respect to Ca in most clays. Increased temperature and concentration should decrease hyperfiltration. For main entry see W69-06950. (Knapp-USGS)
W69-06964

SOLUTE AND SOLVENT FLOW AS INFLUENCED AND COUPLED BY SURFACE REACTIONS,
Colorado State Univ., Fort Collins; Agricultural Research Service, Washington, D. C.; and California Univ., Riverside.
For primary bibliographic entry see Field 02G.
W69-06996

THE SIMULTANEOUS FLOW OF WATER AND HEAT OR SOLUTES THROUGH SOIL,
Utah State Univ., Logan. Dept. of Soils and Meteorology.
For primary bibliographic entry see Field 02G.
W69-06997

SOIL AND SALINITY FACTORS IN IRRIGATION AND DRAINAGE OF MALLEE LANDS,
Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).
For primary bibliographic entry see Field 02G.
W69-07006

SALINE SOIL CLASSIFICATION USING THE 5:1 AQUEOUS EXTRACT,
Centro de Edafologia y Biologia Aplicada del Segura, Murcia, (Spain).
For primary bibliographic entry see Field 03C.
W69-07008

HEXADECANOL IN SOIL- ITS LOCATIONAL STABILITY AND INFLUENCE ON MODULUS OF RUPTURE,
Arizona Agricultural Experiment Station, Tucson; and Arizona Univ., Tucson. Dept. of Agricultural Chemistry and Soils.
For primary bibliographic entry see Field 02G.
W69-07092

FRACTIONATION OF PHOSPHORUS IN LAKE SEDIMENTS: ANALYTICAL EVALUATION,
Connecticut Agricultural Experiment Station, New Haven.
For primary bibliographic entry see Field 02H.
W69-07093

DETERMINATION OF DISSOLVED HYDROCARBONS IN SUBSURFACE BRINES,
Chevron Research Company, La Habra, Calif.
For primary bibliographic entry see Field 05A.
W69-07101

COMPUTER-PRODUCED TABLES, MAPS, AND DIAGRAMS AS TOOLS IN THE INTERPRETATION OF BRINE DATA FROM SOUTHEASTERN KANSAS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 05G.
W69-07102

CHEMICAL COMPOSITION OF SELECTED KANSAS BRINES AS AN AID TO INTERPRETING CHANGE IN WATER CHEMISTRY WITH DEPTH,
Geological Survey, Lawrence, Kans.; Kansas Univ., Lawrence; and Kansas State Geological Survey, Lawrence.
For primary bibliographic entry see Field 05G.
W69-07103

SALINE WATER IN SOUTHEASTERN NEW MEXICO,
Geological Survey, Albuquerque, N. Mex.; and Air Force Weapons Lab., Kirtland AFB, N. Mex.
William L. Hiss, Johannes B. Peterson, and Thomas R. Ramsey.
Proc of Symp on Geochem of Subsurface Brines, Kansas Univ, Mar 25-26, 1968. Chem Geol, Vol 4, No 1-2, pp 341-360, Mar 1969. 20 p, 12 fig, 10 ref.

Descriptors: *Water chemistry, *Brines, *Oil fields, *New Mexico, *Texas, Groundwater movement, Groundwater basins, Groundwater, Aqueous solutions, Saline water systems, Data processing, Data collections, Digital computers, Computer programs, Maps.
Identifiers: *Tabulation, Water quality data, Permian Basin.

Saline waters from formations of several geologic ages are being studied in a 7-county area in southeastern New Mexico and western Texas, including the northern and eastern margins of the Delaware Basin between the Guadalupe and Glass Mountains. Chloride-ion concentrations in water produced from rocks of various ages and depths were mapped in Lea County, New Mexico, using machine map-plotting techniques and trend analyses. Anomalously low chloride concentrations (1,000-3,000 mg/l) were found along the western margin of the Central Basin platform in the San Andres and Capitan Limestone Formations of Permian age. These low chloride-ion concentrations may be due to preferential circulation of groundwater through the more porous and permeable rocks. Data were obtained principally from oil companies and from related service companies. Approximately 20,000 water analyses collected from over 65 sources were coded, recorded on punch cards and stored on magnetic tape for computer operations. Extensive manual and computer error checks for duplication and accuracy were made to eliminate data errors. The original 20,000 analyses considered were reduced to 6,000 representative analyses which are being used in the saline water studies. (USGS)
W69-07104

INCREASING CONCENTRATION OF SUBSURFACE BRINES WITH DEPTH,
Tulsa Univ., Okla.
Parke A. Dickey.
Proc of Symp on Geochem of Subsurface Brines, Kansas Univ, Mar 25-26, 1968. Chem Geol, Vol 4, No 1-2, pp 361-370, Mar 1969. 10 p, 7 fig, 22 ref.

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Descriptors: *Water chemistry, *Brines, *Oil fields, *Geochemistry, *Diagenesis, Saline water systems, Aqueous solutions, Connate water, Chemical reactions.
Identifiers: *Oil-producing rocks, Subsurface brines.

The concentration of deep subsurface brines of the chloride-calcium chemical type normally increases with depth. In many areas the increase is linear over thousands of feet vertically. The rate of increase ranges between 15,000 and 100,000 ppm/1,000 ft. In the Gulf Coast this relationship reverses at great depths. Here, however, the presence of abnormal fluid pressures indicates that processes of compaction and diagenesis are not yet complete. Any hypothesis to account for the chemical composition of these brines must explain the linear nature of the increase in concentration with depth.
W69-07105

LEACHING OF FERTILIZER IONS IN SOIL COLUMNS,
Western Australia Univ., Nedlands. Dept. of Soil Science and Plant Nutrition.
For primary bibliographic entry see Field 05B.
W69-07137

TRANSPORT OF ATRAZINE IN A LATOSOLIC SOIL IN RELATION TO ADSORPTION, DEGRADATION, AND SOIL WATER VARIABLES,
Hawaii Univ., Honolulu. Dept. of Agronomy and Soil Science.
For primary bibliographic entry see Field 05B.
W69-07139

EVALUATION OF THE QUALITY OF IRRIGATION WATERS WITH HIGH BICARBONATE CONTENT IN RELATION TO THE DRAINAGE CONDITIONS,
Institute de Edafologia, Maracay (Venezuela). Facultad de Agronomia.
For primary bibliographic entry see Field 03C.
W69-07144

2L. Estuaries

DETERMINATION OF NITRATE IN ESTUARINE WATERS--COMPARISON OF A HYDRAZINE REDUCTION AND A BRUCINE PROCEDURE AND MODIFICATION OF A BRUCINE PROCEDURE,
Federal Water Pollution Control Administration, Metuchen, N. J. Hudson-Champlain and Metropotitan Coastal Comprehensive Water Pollution Control Project.
Lloyd Kahn, and Francis T. Brezenski.
Environmental Science and Technology, Vol 1, No 7, pp 488-491, June 1967. 2 fig, 2 tab, 18 ref.

Descriptors: *Chemical analysis, *Estuaries, *Nitrates, Nitrogen compounds, Colorimetry.
Identifiers: *Nitrate determination, *Hydrazine reduction procedure, *Modified brucine procedure, Estuarine waters.

Nitrate levels in estuarine waters were evaluated by hydrazine reduction and a brucine procedure. Low results were often obtained with the hydrazine procedure presumably due to depletion of available hydrazine by environmental components in the system, resulting in incomplete reduction of nitrate. The brucine method of Jenkins and Medsker was modified to provide a better behavior of the Beer-Lambert law. The modification involves carrying out the reduction step in boiling water, rather than at 20 deg C. Evidently the reaction kinetics are such that at the elevated temperature no break in the calibration curve is observed, the procedure resulting in the linearity of from 0 to 0.6 milligrams of nitrate-nitrogen per liter. The precision of the modified-brucine procedure was evaluated to be better than 0.03 milligram of nitrate-nitrogen per liter. (Konrad-Wis)
W69-06861

GEOCHEMISTRY OF PORE WATERS FROM SHELL OIL COMPANY DRILL HOLES ON THE CONTINENTAL SLOPE OF THE NORTHERN GULF OF MEXICO,
Geological Survey, Woods Hole, Mass.; and Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 02K.
W69-06954

COASTAL DUNE STRUCTURES FROM PARANA (BRAZIL),
Parana Univ., Curitiba (Brazil). Geological Inst.
For primary bibliographic entry see Field 02J.
W69-06965

NORTHWESTERN AFRICAN CONTINENTAL SHELF SEDIMENTS,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
For primary bibliographic entry see Field 02J.
W69-06966

OFFSHORE SEDIMENTS AND VALLEYS OF THE ORANGE RIVER (SOUTH AND SOUTHWEST AFRICA),
Georgia Univ., Sapelo Island. Marine Inst.; Georgia Univ., Athens. Dept. of Geology; Millersville State Coll., Pa.; and Ocean Science and Engineering, Inc., Washington, D. C.
For primary bibliographic entry see Field 02J.
W69-06967

X-RAY ANALYSES OF CLAY MINERALS IN SOME RECENT FLUVIATILE SEDIMENTS ALONG THE COASTS OF CENTRAL ITALY,
Amsterdam Univ., (Netherlands).
For primary bibliographic entry see Field 02J.
W69-07009

EXPERIMENTAL INVESTIGATION ON THE EROSION-SENSITIVITY OF A SAND-CLAY LAMINATION,
Ministry of Transport and Waterways, The Hague (Netherlands); and Waterloopkundig Laboratorium, Delft (Netherlands).
For primary bibliographic entry see Field 02J.
W69-07130

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

CHARACTERIZATION OF BRINES FOR ECONOMIC ANALYSIS,
Dow Chemical Co., Freeport, Tex.
W. F. McIlhenny, P. E. Muehlberg, and H. G. Smith.
Chem Geol, Vol 4, No 1-2, pp 9-35, Mar 1969. 28 p, 7 fig, 7 tab, 14 ref. Proc of Symp on Geochem of Subsurface Brines, Kansas Univ, Mar 25-26, 1968.
OSW 15-01-0001-392.

Descriptors: *Brines, *Saline water, *Classification, *Data processing, *Computer programs, Desalination, Chemical analysis, Chemical precipitation, Chemical properties, Salts, Aqueous solutions.
Identifiers: Chemical classification.

To study the utilization of waste brines from desalination, a method of classifying brines by chemical composition using a computer was developed, based on the chemical system in which the brines crystallize and the composition of the solid phases produced by crystallization. The 7-component system of Na, K, Mg, Ca, Cl, sulfate, and bicarbonate is divided into 3 quinary systems, each of which is completely described for computer processing by locating all invariant points, planes, and corner points of the solid phase regions. Descriptions of 1,552 brines useful as input to desalination plants are cataloged, sorted, and classified by a FORTRAN IV program. Flow charts describing the program are included. For main entry see W69-06950. (Knapp-USGS)
W69-06951

3B. Water Yield Improvement

WATER CAPTURE IN SOIL SURFACE MICRODEPRESSIONS FOR CROP USE,
Agricultural Research Service, State College, Miss.; and Agricultural Research Service, Watkinsville, Ga. Soil and water Conservation Research Div.
For primary bibliographic entry see Field 03F.
W69-07149

3C. Use of Water of Impaired Quality

GEOCHEMISTRY OF SUBSURFACE BRINES.
Kansas Univ., Lawrence. Dept. of Civil Engineering; Kansas State Geological Survey, Lawrence; and Louisiana State Univ., Baton Rouge. School of Geology.
For primary bibliographic entry see Field 02K.
W69-06950

SALT ACCUMULATION PROCESSES IN THE HUNGARIAN DANUBE VALLEY,
Magyar Tudomanyos Akademia Talajtani es Agrokemiai Kutato Intezete, Budapest.
Gy. Varallyay.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 371-380, 1968. 10 p, 4 fig, 1 tab, 14 ref.

Descriptors: *Saline soils, *Irrigation, *Alkaline soils, Salt tolerance, Impervious soils, Clays, Ion exchange, Soil structure, Soil chemical properties, Soil types, Saline water, Calcareous soils, Water table, Drainage, Groundwater movement, Evaporation.
Identifiers: *Hungary, *Danube Valley.

Many of the salt-affected soils of Hungary occur in the Danube Valley. Here the main causes of the formation and the low fertility of the solonchak, solonchak-solonetz and calcareous solonchakized solonetz soils are their high sodium bicarbonate and carbonate contents. Part of the rain water falling on the extensive catchment areas of the periphery of the Danube basin infiltrates into the soil and becomes enriched in calcium or sodium bicarbonates, depending upon the source rock material. This water moves towards the deeper parts of the adjacent subsurface drainage basin lined with the Pannonian substratum and then accumulates in the stagnant groundwater basin of the Danube Valley. At places where the static groundwater is within 2 m of the surface, evaporation from the groundwater greatly exceeds infiltration, especially during summer. This produces a concentration of salts in the groundwater. The alkaline-earth bicarbonates precipitate as insoluble carbonates. Only the easily soluble sodium salts remain in solution, migrate and become distributed in the soil profile according to their solubility. Ultimately salt accumulation horizons develop in the interzone of upward and downward water movement.
W69-07002

HYDRAULIC CONDUCTIVITY OF SOME TROPICAL SOILS AS A GUIDE TO IRRIGATION WATER QUALITY,
Hawaii Univ., Honolulu. Coll. of Tropical Agriculture; Hawaii Inst. of Geophysics, Honolulu; and Hawaii Univ., Honolulu. Dept. of Agronomy and Soil Science.
S. A. El-Swaify, and L. D. Swindale.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 381-389, 1968. 9 p, 4 fig, 1 tab, 16 ref.

Descriptors: *Irrigation water, *Saline water, *Soil chemical properties, *Hawaii, *Hydraulic conductivity, Soil physical properties, Permeability, Soil water movement, Drainage, Leaching, Clays, Laterites.
Identifiers: Tropical soils, Latosols.

Relatively high levels of salinity and high proportions of sodium in irrigation waters may be tolerated if the soil allows sufficient downward movement of the large water applications necessary to prevent salt accumulation, and resists detrimental peptization. A tropical Red Earth and an Andosol were tested for these conditions using hydraulic conductivity measurements, employing solutions of sea water composition and homoionic solutions of Mg, Ca, and Na chlorides. Concentration of applied waters ranged from a high of 0.61 N to a low of 0.012 N in homoionic solutions and to 0.006 N for sea water. Subsurface soils maintained very high and essentially unchanged conductivities under all application. Under these conditions (at which many temperate zone soils are practically impermeable), infiltration values of 2.85 and 0.875 cm/hr were obtained for surface Tropical Red Earths and Andosols, respectively. Alternate applications of sea and distilled water caused slight structural changes even though the distilled water removed all soluble salts from highly sodium-saturated soils. It may be possible to increase the permissible limits of salinity and sodium in irrigation water for such soils. This finding has important implications in that these soils are widespread in tropical regions where additional sources of irrigation water are generally needed for effective development.
W69-07003

QUALITY OF IRRIGATION WATER,
Indian Council of Agricultural Research, New Delhi; and Punjab Agriculture Univ., Hissar (India).
J. S. Kanwar, and B. S. Kanwar.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 391-403, 1968. 13 p, 1 fig, 5 tab, 24 ref.

Descriptors: *Irrigation water, *Water quality, *Saline water, *Soil chemical properties, Soil physical properties, Hydraulic conductivity, Permeability, Soil water movement, Drainage, Leaching, Clays, Soil types, Soil structure, Sodium compounds, Bicarbonates, Chlorides.
Identifiers: Salinity hazard, Sodium absorption ratio.

The effects of irrigation water containing 7.5, 22.5, 50.0 and 100 m-equiv/l of salt and sodium adsorption ratios of 4,8,16, and 26 on soil and crops were studied, applying 90 acre-inches of water to 2 crops of maize and 1 of wheat grown in succession. In a second experiment the effects of various levels of residual sodium carbonate (0.1, 1.25, 2.50 and 5.0 m-equiv/1) on the soil and crops were studied. It was observed that the yields of all crops decreased as the salt concentration of water increased. The germination of the 2nd crop of maize and 3rd crop, wheat, could not occur under the treatment of 200 m-equiv/1 of salts. A reduction in yield of 50% in the 2nd crop of maize occurred with a treatment of 50 m-equiv/1 of salts. The effect of increase of SAR of water on the crop yield was not so marked but the combined effect of electrolyte concentration and SAR was quite marked. The source of residual sodium carbonate, whether carbonate or bicarbonate, and the ionic composition of applied water are important. Moreover, it is the nature of the soil and the cumulative effect of a given water on the soil which will determine its effect on the crops. Triangular diagram methods involving the consideration of soil, water and plant may be used in determining the quality of water for irrigation purposes.
W69-07004

THE PROBLEM OF MAKING WASTE WATER SAFE AND ITS USE IN IRRIGATING LIGHT CHESTNUT SOILS IN THE POVOLZHYE AREA,
Volgograd Agricultural Inst. (USSR).
V. F. Shubin.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 405-413, 1968. 9 p, 2 tab.

Descriptors: *Irrigation water, *Water reuse, *Municipal wastes, *Industrial wastes, Water quality, Sewage disposal, Irrigation design, Leaching, Soil-water plant relationships, Water spreading.
Identifiers: *USSR.

Test of flood-irrigation with combined municipal-industrial waste water were made to study infiltration, crop suitability, and salinity hazard of the water. Crops should be fast-growing and shade the soil well to retard evaporation and salinization. Rice and wheat are good early crops, and orchards and vineyards are profitable. Ground cover should be maintained because bare soil evaporation causes salinization. In the test plots there was no problem with salinization; in fact, there was a decrease of salinization and solonchak formation, and a flushing downward of salts. Irrigation of a plot at 3,000 cu m/ha in July 1965 resulted in 62% reduction of alkalinity, 69% Na, and 32% Cl, and a 24% increase in Ca and sulfates in the 0-50 cm layer. (Knapp-USGS)
W69-07005

SALINE SOIL CLASSIFICATION USING THE 5:1 AQUEOUS EXTRACT,
Centro de Edafologia y Biologia Aplicada del Segura, Murcia, (Spain).
O. Carpena, M. G. Guillen, F. G. Fernandez, and M. Caro.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 483-490, 1968. 8 p, 1 fig, 3 tab, 14 ref.

Descriptors: *Saline soils, *Soil types, *Chlorides, *Electrical conductivity, Soil water, Irrigation, Drainage, Saline water, Irrigation water.
Identifiers: *Soil extracts.

Saline soils in SE Spain occupy 10,000 ha and the area is increasing because of improper irrigation techniques and the use of saline irrigation water. Soil salinity was determined by the use of soil extracts. Soil salinity and salinization maps were prepared. Chloride concentrations and electrical conductivity of the extracts were used in a diagram to classify soils. The relationship between salinity of extracts and chloride content was established by regression analysis of over 88 samples. (Knapp-USGS)
W69-07008

SPRAY IRRIGATION OF ORGANIC CHEMICAL WASTES,
Commercial Solvents Corp., Terre Haute, Ind.
For primary bibliographic entry see Field 05D.
W69-07114

EVALUATION OF THE QUALITY OF IRRIGATION WATERS WITH HIGH BICARBONATE CONTENT IN RELATION TO THE DRAINAGE CONDITIONS,
Institute de Edafologia, Maracay (Venezuela). Facultad de Agronomia.
Ildefonso Pla.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 357-370, 1968. 14 p, 3 fig, 4 tab, 12 ref.

Descriptors: *Irrigation water, *Bicarbonates, *Drainage, *Leaching, *Alkaline water, Return flow, Soil water, Soil chemistry, Soil structures, Sodium compounds, Saline soils, Alkaline soils.
Identifiers: *Venezuela, Sodium-bicarbonate water, Sodium hazard, Sodic soils.

In Venezuela, where most of the irrigation waters have a very high bicarbonate content, the actual and potential development of sodic and saline-sodic soils is a limiting factor for the permanence of a successfully irrigated agriculture. Data obtained in laboratory and greenhouse experiments, with very well controlled irrigation and drainage using different soils and waters of different composition were used as a basis for developing a logical and simple method for predicting the effects, and for calculating the leaching requirements to prevent the development of saline-sodic or sodic soils, when waters with high bicarbonate content are used for irrigation. The method is based on the separate calculation of the possible accumulation of the different ions in the soil solution. The influence of the leaching conditions on Na accumulation and structural deterioration was much more marked when waters with high bicarbonate content were used. With irrigation being the only supply of water, the effects on salts and Na accumulation were initially higher in the surface soil, decreasing with depth. These differences were more striking when the physical properties of the soil were favourable for the capillary rise of water. In both cases the Na accumulation was related to the existence of favourable conditions for calcium carbonate precipitation and concentration of salt in the soil solution.
W69-07144

MELIORATIVE EFFECT OF DIRECT ELECTRIC CURRENT ON LEACHING SOLONCHAKOUS SOLONETZ,
Moscow State Univ. (USSR). Faculty of Biology and Soil.
For primary bibliographic entry see Field 02G.
W69-07145

THE SALTING FACTORS OF IRRIGATED SOILS IN THE TURAN PLAIN,
Akademiya Nauk Kazakhskoi SSR, Alma-Ata. Institut Pochvovedeniya.
V. M. Borovskiy.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 473-481, 1968. 9 p, 19 ref.

Descriptors: *Saline soils, *Drainage, *Water levels, *Evaporation, *Irrigation, Water quality, Salts, Sodium compounds, Soil types, Chlorides, Groundwater movement, Climates, Arid lands.
Identifiers: *USSR, Turan Plain.

The Turan Plain occupies vast areas of the deserts in Central Asia and South Kazakhstan. More than 60% of the irrigated soils of the USSR are situated here. The climate is continental, with dry, hot and long summers, and short, frosty winters. Potential evaporation is 10 to 20 times larger than the average precipitation. The layer in which migration of the water-soluble salts takes place varies in depth from 100 to a few meters and consists of colluvial gravel covered with loess and alluvium of a binary structure derived from schists. The accumulation of salts in the soil, rocks and water is associated with the natural drainage. In the Piedment region where there is gravel and drainage is adequate, salts do not accumulate and there is no danger of secondary salinization. In the regions with less adequate drainage, there is an accumulation of salts, and secondary salinization is a danger after the development of irrigation. Very large quantities of salts have accumulated in the drainless alluvial-deltaic plains, where a high concentration of salts is found in the groundwater. On irrigation strong salinization takes place. Regulation of the water-salt system is necessary to prevent salinization. The salt reserves and the hydrologic properties of the entire layer from the surface of the soil to the water table must be taken into account.
W69-07146

3D. Conservation in Domestic and Municipal Use

WATER AND WATERCOURSES.
For primary bibliographic entry see Field 06E.
W69-06886

3F. Conservation in Agriculture

WORKSHOP ON WATER RESOURCE PROBLEMS AND RESEARCH NEEDS RELATED TO AGRICULTURE IN THE COASTAL PLAINS OF NORTH CAROLINA,
North Carolina Univ., Chapel Hill. Water Resources Research Inst.
George Kriz.
Sum of Workshop on Water Resources Probl in NC, Mar 14, 1969, Kinston, NC. 22 p. OWRR Proj No A-999-NC.

Descriptors: *Water resources development, *Planning, *Project planning, *North Carolina, Water requirements, Water utilization, Drainage, Irrigation, Agricultural chemicals, Pesticides, Water pollution, Water supply, Waste disposal.
Identifiers: Water resources research.

A workshop was held to discuss the North Carolina problems of land drainage, irrigation, agricultural chemicals, animal and human wastes, and farm water supplies, to identify and define research needs directed to recognized problems, and to suggest research priorities in these fields. The results of the discussion are summarized and the recommendations are tabulated. (Knapp-USGS)
W69-06945

SOIL AND SALINITY FACTORS IN IRRIGATION AND DRAINAGE OF MALLEE LANDS,
Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).
For primary bibliographic entry see Field 02G.
W69-07006

WATER CONSERVATION IN THE SUBHUMID, NORTH LATITUDE PART OF THE CORN BELT OF UNITED STATES,
Agricultural Research Service, Morris, Minn. Soil and Water Conservation Research Div.
R. R. Allmaras, and R. F. Holt.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 291-302, 1968. 12 p, 2 fig, 4 tab, 14 ref.

Descriptors: *Water conservation, *Water storage, *Soil water, *Corn belt, Surface-groundwater relationships, Soil-water-plant relationships, Irrigation, Supplemental irrigation, Crop production, Rainfall.
Identifiers: Soil water storage, Crop geometry.

The northwest Corn Belt of the United States is a subhumid area in which corn and soybean yields are often limited by water deficiency and early-season low temperature. With average midsummer rainfall, as much as 13 cm of water is used from soil storage. The probability of less than 13 cm of stored available water at planting is about 0.25. Soil storage of water was measured in each of 3 dormant-season and 2 growing-season periods. Storage predictions show quantative and systematic aspects of the storage model for each period and over the whole dormant season. Variation of plant spacing and use of temporary field windbreaks change water-use efficiency but do not produce measurable changes of evapotranspiration. Tillages that show both large evaporation (with ample supply of subsoil water) and infiltration rates also produce greater net storage even where no runoff occurs. Water distribution after intake cessation is suggested as a limiting factor for water storage. A tilled layer water storage model suggests limits on the possible value of tillage for increasing water storage.
W69-07141

THE EFFECT OF GYPSUM ON THE WATER STORAGE IN A SANDY LOAM SOIL UNDER AN IRRIGATED PERENNIAL PASTURE,
Commonwealth Scientific and Industrial Research Organization, Riverina (Australia). Riverina Lab.
B. J. Bridge, and C. R. Kleinig.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 313-323, 1968. 11 p, 1 fig, 3 tab, 14 ref.

Descriptors: *Water storage, *Irrigation water, *Water yield improvement, *Soil treatment, Gypsum, Soil amendments, Ion exchange, Soil structure, Hydraulic conductivity, Permeability, Infiltration.
Identifiers: *Australia, Soil water storage improvement.

White clover (Trifolium repens L.) was grown at three irrigation frequencies with and without a top dressing of gypsum applied at 10 metric tons/ha, on a coarse textured soil which had a sandy loam A horizon of 15 cm depth underlain by a sandy clay B horizon of low hydraulic conductivity. Field measurements showed that gypsum application significantly increased the soil moisture storage before and after irrigation at all irrigation frequencies, but had no effect on the bulk density of the soil profile. Laboratory measurements showed that gypsum application increased the hydraulic conductivity of the subsoil, increased the exchangeable calcium in the soil profile, and decreased the exchangeable sodium plus magnesium. These soil changes were accompanied by significantly increased production of white clover. At a 7-day irrigation interval, the average growth rate rose from 18.0 to 43.4 kg/ha/day. At each irrigation frequency, the water increment in the soil profile at irrigation was similar for both gypsum and nil gypsum treatments, indicating that gypsum application resulted in an increased efficiency of use of applied irrigation water in terms of clover production.
W69-07142

THE ACHIEVEMENTS OF DRAINAGE THEORY IN RELATION TO PRACTICAL NEEDS: TAKING STOCK,
Agricultural Research Council, Cambridge (England). Unit of Soil Physics.
For primary bibliographic entry see Field 02G.
W69-07143

WATER CAPTURE IN SOIL SURFACE MICRODEPRESSIONS FOR CROP USE,
Agricultural Research Service, State College, Miss.; and Agricultural Research Service, Watkinsville, Ga. Soil and water Conservation Research Div.
R. R. Bruce, D. L. Myhre, and J. O. Sanford.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 325-330, 1968. 6 p, 1 fig, 1 tab, 4 ref.

Descriptors: *Water conservation, *Infiltration, *Cultivation, *Depression storage, Droughts, Southeast U.S., Crop production, Crop response, Surface-groundwater relationships, Runoff, Soil physical properties.
Identifiers: Soil surface roughening, Infiltration improvement.

Because the relatively abundant rainfall in the Southeastern United States is often unevenly distributed, water for plant growth may not be naturally sufficiently available at times when it is most needed by crops. This problem could be partly alleviated if a method were developed for retaining more rainfall for a longer time in the soil profile. Experiments compared rough and smooth soil surfaces on a Vertic Haplaquoll soil in Mississippi. The purpose of these studies was to investigate the possibility that a rough soil surface would increase surface detention of water and subsequent soil water supply for crop use. The rough surface was created by spading the interrow zone a few days after planting corn, the test crop; smooth surface plots were conventionally disked. In 1 of 2 years, the rough soil surface resulted in significantly greater corn yields. Associated with the yield increase was a larger amount of soil water in the profile during the critical water requirement period of meiosis and anthesis. It may be concluded that the greater depression storage capacity of the rough surface led to an increased amount of rainfall captured, infiltrated, and temporarily stored in the soil for plant use.
W69-07149

ECONOMIC ASPECTS OF WATER RESOURCE POLICY,
Wisconsin Univ., Milwaukee.
For primary bibliographic entry see Field 06B.
W69-07159

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

DRAINAGE AND RECLAMATION OF LANDS.
For primary bibliographic entry see Field 06E.
W69-06872

FINDLEY LAKE PROPERTY OWNERS, INC V TOWN OF MINA (COMPETING USES).
For primary bibliographic entry see Field 06E.
W69-06873

WHEATLEY V CASS COUNTY (ACTION TO PREVENT CONSTRUCTION OF DRAINAGE CULVERT UNDER HIGHWAY).
For primary bibliographic entry see Field 06E.
W69-06877

HUNT V SMITH (DAMAGE BY OBSTRUCTION TO NATURAL FLOW).
For primary bibliographic entry see Field 06E.
W69-06878

AMORY V COMMONWEALTH (DAMAGES FOR DIVERSION).
For primary bibliographic entry see Field 06E.
W69-06879

JONES V PENNSYLVANIA RR (DAMAGES CAUSED BY DIVERSION OF WATER).
For primary bibliographic entry see Field 06E.
W69-06891

WHITE V WABASH RR (ACTION FOR DAMAGES DUE TO ALLEGED DIVERSION OF SURFACE WATERS).
For primary bibliographic entry see Field 06E.
W69-06895

FULTON V TOWN OF BELMONT (DAMAGE FROM OVERFLOW OF STORM DRAINS).
For primary bibliographic entry see Field 06E.
W69-06896

FLOOD COVERAGE: NEW CHALLENGE FOR INSURANCE.

J of Amer Ins, Vol 45, No 2, pp 13-16, Mar-Apr 1969. 4 p, 2 pic.

Descriptors: *Flood plain insurance, *Flood damage, Flood control, Flood protection, Risks, Cost sharing, Federal government, Local governments, Feasibility studies, Nonstructural alternatives, Disasters, Land use, Land development, Legislation, Legal aspects, State governments.

The struggle to provide a feasible insurance program to aid flood victims has been a long and difficult one. Steadily mounting flood losses have kept the idea of a flood insurance program alive. The activities of the Department of Housing and Urban Development, the National Association of Insurance Commissioners, and members of the property insurance industry have resulted in the National Flood Insurance Act of 1968 which authorized the Secretary of HUD to borrow up to $250 million to implement a flood insurance pro-

gram. The Act requires that state and local governments cooperate by adopting and enforcing land use provisions to restrict future development of land in flood-prone areas in order not to perpetuate the current problem. Under the program, flood insurance will be sold and claims serviced by private insurance companies. The federal government will assist property owners by paying a share of the determined premiums and providing reinsurance, which will be purchased by the companies as a means of protecting themselves and their policyholders against catastrophic losses. (Carruthers-Fla)
W69-06898

CITY OF PASSAIC V CITY OF CLIFTON (COORDINATED FLOOD CONTROL PLANS).
For primary bibliographic entry see Field 06E.
W69-06901

JACOBSON V KANDIYOHI (CONSTRUCTION OF A DRAINAGE DITCH).
For primary bibliographic entry see Field 06E.
W69-06903

BUNDY V CITY OF SULLIVAN (ARTIFICIAL CONTROL OF SURFACE DRAINAGE).
For primary bibliographic entry see Field 06E.
W69-06910

DANZIGER V UNITED STATES (EMINENT DOMAIN FOR LEVEE CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W69-06919

PASSAIC VALLEY FLOOD CONTROL COMM'N; FLOOD CONTROL.
For primary bibliographic entry see Field 06E.
W69-06921

FLOOD CONTROL.
For primary bibliographic entry see Field 06E.
W69-06922

FLOOD CONTROL AND BEACH EROSION: STATE ASSISTANCE.
For primary bibliographic entry see Field 06E.
W69-06940

FLOOD CONTROL AND BEACH EROSION (STATE ASSISTANCE).
For primary bibliographic entry see Field 06E.
W69-06941

FLOOD PLAIN INFORMATION STUDY, JACKSON, TENNESSEE.
Corps of Engineers, Memphis, Tenn.

Corps Eng Flood Plain Rep, May 1967. 23 p, 5 plate, 3 photo, 35 ref, tech append. Prepared for Jackson Municipal Regional Planning Comm.

Descriptors: *Floods, *Flood damage, *Tennessee, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Forked Deer River (Tenn), Jackson (Tenn), Standard project flood, Intermediate regional flood.

Flooding of the South Fork of the Forked Deer River, North Fork Drainage Canal, and Bond Creek, Jackson, Tennessee is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-07013

GULF REFINING CO V DAVIS (SEEPAGE FROM A SALT WATER PIT).
For primary bibliographic entry see Field 06E.
W69-07016

HOLLIDAY V CITY OF GREENVILLE (ALTERATION OF NATURAL DRAINAGE CONDITIONS).

78 SE 2d 279-289 (S C 1953).

Descriptors: *South Carolina, *Surface drainage, *Storm drains, *Flood damage, Surface runoff, Damages, Erosion, Cities, Drainage, Floods, Repulsion (Legal aspects), Storm runoff, Surface waters, Outlets, Ditches, Discharge (Water), Legislation, Flow augmentation, Alteration of flow, Natural flow, Judicial decisions, Value, Drainage engineering, Drainage effects.

Respondent owned land situated in appellant city. Prior to 1950, drainage water from the surrounding public streets and respondant's land flowed over and off the land causing no harm. In 1950 appellant constructed curbs, gutters, and drainage basins which caused drainage water to be concentrated and discharged in greater volumes across respondent's land. This condition greatly reduced the value of respondent's tract. A statute required the city to provide adequate drainage, and such drainage was to be provided along a public thoroughfare, not over private land adjacent thereto unless the owner consented. From a judgment for respondent, the city appealed. The court held that the damage to respondent's land resulted from destruction of the natural drainage by the city's employees. The court noted that a city is not necessarily liable for damage from a change in a drainage system; it is liable, however, if the natural drainage is destroyed. The measure of damages in such a case is not the increase in amount of water flowing on the land; rather, it is the amount of damage from the increase in flow with due regard for the adequate drainage prior to the change. (Helwig-Fla)
W69-07018

COSTANZO V STATE (CONTROL OF SURFACE WATERS AND THE NATURAL FLOW DOCTRINE).
207 Misc 242, 137 NYS 2d 878-885 (N Y Ct Cl 1955).

Descriptors: *New York, *Natural flow, *Flood damage, *Surface waters, Excessive precipitation, Obstruction to flow, Judicial decisions, Drainage, Ditches, State governments, Surface runoff, Pipes, Culverts, Muck lands, Construction, Surface drainage, Drainage water, Storm runoff, Floods protection, Highways, Legal aspects.
Identifiers: Proximate cause.

Plaintiffs brought suit to recover for flood damage allegedly caused by defendant's construction of a highway. Plaintiffs could only recover if they showed that defendant collected a body of surface water which would not naturally flow toward plaintiffs' lands, and further, that such waters were cast upon plaintiffs' lands. On the basis of substantial expert testimony, the court entered a judgment in favor of the defendant. The evidence indicated that defendant was not negligent and, in fact, that it was careful to design its highway in such a way as to take advantage of the natural flow of surface waters. Defendant did not alter the natural flow but merely increased its volume; for this there is no liability. The court further found that the flooding of the plaintiffs' land was caused by excessive precipitation, thus breaking the causal connection between defendant's activities and the ultimate damage to the plaintiff. (Stewart-Fla)
W69-07023

ATKINSON V UNITED STATES (FEDERAL LIABILITY FOR DAM BACKWATER).
For primary bibliographic entry see Field 06E.
W69-07025

HURD V STATE (NEGLIGENT DISCHARGE OF CANAL WATER).

64 NYS 2d 896-902 (Ct Cl 1946).

Descriptors: *New York, *Flood damage, *Floodgates, *New York State Barge Canal, Flooding, Damages, Judicial decisions, Streams, Canals, Orchards, Legal aspects, Obstruction to flow, Ice, State governments, Barriers, Diversion, Discharge (Water), Prescriptive rights, Easements.
Identifiers: Res ipsa loquitur, Presumptions.

Plaintiffs sought to recover for damages allegedly caused by the State of New York when barge canal gates were opened and water was discharged into a frozen creek which subsequently overflowed and damaged plaintiffs' cherry trees. The state did not have a prescriptive right to flood plaintiffs' land. Plaintiff contended that the state was negligent in allowing the canal water to rise to abnormal height before discharging and in opening all the canal gates simultaneously so as to discharge unnecessarily large volumes of water into the stream. The court held the state liable, applying the doctrine of res ipsa loquitur since the barge canal gates were in the exclusive control of the state, the evidence showed the accident would not have occurred without negligence, and no explanation was forthcoming from the state. (Kahle-Fla)
W69-07027

ALTERATION OF HIGHWAYS.

Conn Gen Stat Ann sec 13a-128, 13a-136, 13a-138 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *Surface drainage, *Reservoir construction, *Flood control, Legislation, Highways, Road construction, Dike embankments, Dams, Diversion structures, Flood protection, Drainage water, Controlled drainage, Cost allocation, Cost-benefit ratio, Reservoirs, Tidal effects, Overflow, Water supply, Cities, Highway relocation.

Any municipal or private corporation which provides a town's water supply may, if necessary, apply to the governing council of any town to have the use of any public highway discontinued or altered in order to enable it to construct or enlarge a reservoir. If the council denies the application or fails to act upon it for thirty days, the corporation may petition the superior court, stating that such discontinuance is essential to the public interest. Whenever a town lays out a public highway across lowlands which are susceptible to tide overflow and the highway is used as a dike to prevent such overflow, the owners may be assessed for the benefits; however, not more than one-half the cost of the highway shall be assessed to the owners. Any person authorized to construct or repair highways may drain any imposing waters onto private lands, but such drainage must be done in a manner causing the least damage. However, no drainage is allowed into the yard of any residence or areas used exclusively for the storage and sale of foods. (Stewart-Fla)
W69-07053

DRAINAGE SYSTEMS.
For primary bibliographic entry see Field 06E.
W69-07064

GAITHER V ALBEMARLE HOSP (OBSTRUCTION TO NAVIGABLE STREAM AS A PUBLIC NUISANCE).
For primary bibliographic entry see Field 06E.
W69-07079

LIBRARY U. OF I., URBANA-CHAMPAIGN

FLOOD PLAIN INFORMATION, LAGUNA CANYON, ORANGE COUNTY, CALIFORNIA.
Corps of Engineers, Los Angeles, Calif.

Corps Eng Flood Plain Rep, Mar 1969. 31 p, 18 fig, 24 plate, 5 tab.

Descriptors: *Floods, *Flood damage, *California, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Orange County (Calif), Laguna Canyon, Standard project flood, Intermediate regional flood.

Flooding of Laguna Canyon, Orange County, California is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches.
W69-07106

FLOOD PLAIN INFORMATION, CAGUITAS RIVER, CAGUAS, PUERTO RICO.
Corps of Engineers, Jacksonville, Fla.

Corps Eng Flood Plain Rep, Jan 1969. 33 p, 7 fig, 12 plate, 5 tab.

Descriptors: *Floods, *Flood damage, *Puerto Rico, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Caguas (PR), Caguitas River, Standard project flood, Intermediate regional flood.

Flooding of the Caguitas River, Caguas, Puerto Rico, is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches.
W69-07107

FLOOD PLAIN INFORMATION, OUACHITA RIVER, ARKADELPHIA, ARKANSAS.
Corps of Engineers, Vicksburg, Miss.

Corps Eng Flood Plain Rep, Feb 1969. 35 p, 20 fig, 8 plate, 5 tab.

Descriptors: *Floods, *Flood damage, *Arkansas, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Arkadelphia (Ark), Ouachita River, Standard project flood, Intermediate regional flood.

Flooding of the Ouachita River, Arkadelphia, Arkansas is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-07108

FLOOD PLAIN INFORMATION, FEATHER RIVER, NICOLAUS, CALIFORNIA.
Corps of Engineers, Sacramento, Calif.

Corps Eng Flood Plain Rep, Nov 1968. 35 p, 10 fig, 12 plate, 8 tab.

Descriptors: *Floods, *Flood damage, *California, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Feather River, Nicolaus (Calif), Standard project flood, Intermediate regional flood.

Flooding of the Feather River, Nicolaus, California is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-07127

UNITED STATES V HUGHES (FLOWAGE EASEMENT).

408 F 2d 619-621 (6th Cir 1969).

Descriptors: *Tennessee, *Easements, *Tennessee Valley Authority Project, *Dams, Reservoirs, Backwater, Floods, Streams, Water level fluctuations, Riparian rights, Riparian lands, Proprietary power, Real property, Judicial decisions, Legal aspects, Flow.

The TVA brought action as grantee of a flowage easement to require the defendant landowner to remove certain house trailers situated within the boundaries of that easement. The easement was procured from the defendant's predecessor in title and was properly recorded in the year of its purchase. The purpose of the easement was to provide the TVA with the permanent right to overflow the area with backwater impounded by a dam across the Watuga River. The court found that the house trailers had become immobile structures on the easement and that their presence materially violated the purpose of the easement. The court noted that the TVA purchased the easement for the purpose of flood control and that this objective could hardly be accomplished if the area into which flood waters were to be diverted had private dwellings thereon. The court held that the defendant had constructive notice of the recorded easement and remanded the case to the district court for further proceedings. (Katz-Fla)
W69-07200

OBSTRUCTIONS.
W Va Code Ann sec 17-16-1 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Obstruction to flow, *Drainage water, *Diversion structures, Ditches, Channels, Legislation, Drainage, Administrative agencies, Surface drainage, Alteration of flow, Natural flow doctrine, Watercourses, Surface runoff, Drainage systems, Barriers, Abatement, Highways, Legal aspects.
Identifiers: Injunctions (Prohibitory).

'Obstructions,' within the meaning of the statute, include ashes, earth, stone or other material placed on a public road, or in any ditch or waterway along such road. Water diverted from its regular course or channel so as to injure or endanger a public road is an obstruction. Also included within the definition of an obstruction is any road connected without lawful authority to a public road so as to obstruct or impede the flow of water in drains alongside the road. Such obstructions are declared to be public nuisances, and the county court or State Road Commission may apply to a court of competent jurisdiction for an injunction to abate such nuisance. (Stewart-Fla)
W69-07216

SLACK-WATER DAMS (NATURAL RESOURCES ACT).

W Va Code Ann sec 20-5-6 through 20-5-13 (1966).

Descriptors: *West Virginia, *Natural resources, *Water conservation, *Dams, Ponds, Rivers, Lakes, Surface waters, Bridges, Culverts, Highways, Road construction, Water storage, Reservoirs, Dam construction, Damsites, Legal aspects, Legislation, Project planning, Administrative agencies, Water supply, Cost allocation.
Identifiers: *Slack-water dams.

The Director of the Department of Natural Resources may request the State Road Commissioners to construct and maintain slack-water dams in connection with construction of public highways, bridges, culverts, or viaducts. The purpose of the slack-water dams is to create reservoirs, ponds, water parks, basins, lakes, or other incidental works to conserve the water supply of the state. Upon approval by the public authority in charge of construction, the director, state road commissioner, and the authority shall cooperate in formulating plans and in distributing costs for the dam construction. Any department of state government, county, city, park board, organization, corporation, or person may petition for construction of slack-water dams. The Director may review such petitions. The Director is responsible for supervision and care of all slack-water dams and reservoirs, ponds, basins, and lakes created by the dams. The projects may be maintained by leasing operators, but title to or lease of the lands and waters, and related riparian rights will otherwise be retained by the Division. Plans for new highways and bridges are to be coordinated with existing projects. (Kelly-Fla)
W69-07220

UNITED STATES V VIRGINIA ELECTRIC AND POWER CO (COMPENSATION FOR GOVERNMENT CONDEMNATION OF A FLOWAGE EASEMENT).

365 U S 624-645 (1961).

Descriptors: *Federal government, *Easements, *Condemnation value, *Navigable waters, Eminent domain, Compensation, Legal aspects, Land tenure, Project planning, Water utilization, Hydroelectric plants, Flow, Judicial decisions.
Identifiers: *Flowage easements, *Dominant servitude, *Roanoke River, *Subservient fee, Navigational servitude.

Under congressional authorization of a dam project, the federal government acquired a flowage easement over a tract of land. Respondent power company held a flowage easement over a tract within the tract appropriated by the government, and its easement was destroyed by the appropriation. In condemnation proceedings in district court, respondent received substantial damages. The court of appeals affirmed. On appeal to the U S Supreme Court the government claimed that respondent's easement had no compensible value when appropriated by the United States. The Supreme Court held that although the government had a 'dominant navigational servitude' to appropriate navigable waters to its use without compensation, no such right extended to fast lands. Compensation for fast lands taken by the government must be based on possible use not connected with the flow of the navigable stream appropriated. The Court felt the value of respondent's easement equaled the value of the subservient fee, since it had complete destructive control over the fee. The Court felt the value was the 'nonriparian' value of the servient land discounted by the improbability of the easement's exercise, with no weight given the

prospect of government appropriation. The cause was remanded for redetermination of damages. Three justices dissented in favor of the government view. (Harris-Fla)
W69-07221

CONNECTICUT RIVER FLOOD CONTROL COMMISSION.

Conn Gen Stat Ann sec 25-99 (1960).

Descriptors: *Connecticut, *Legislation, *Interstate compacts, *Interstate rivers, Interstate commissions, New Hampshire, Vermont, Massachusetts, Dams, Hydraulic structures, Reservoirs, Dikes, Levees, Flood protection, Flood control, Runoff, Public health, Public benefits, State governments, Water resources development, Federal government, United States, Streams, Hydroelectric power, Recreation, Water supply, Watersheds (Basins), Government finance, Taxes.

The Connecticut River Valley Flood Control Commission was established by this interstate compact to assure adequate storage capacity for impounding the waters of the Connecticut River and its tributaries in order to insure the protection of life and property from floods. The twelve member Commission is a politico-corporate entity endowed with full legal personality. New Hampshire, Vermont, Massachusetts, and Connecticut are equally represented on the Commission. The compact recognizes that construction by the United States of dams and reservoirs along the river valley will result in removal of certain lands from the tax rolls of the situs state. In order to compensate for tax losses, the compact provides that the states benefitted by such construction shall reimburse the situs state for a fixed percentage of such loss. Upon request of the governor of the damaged signatory state, the Commission shall assess the loss based on the current tax rate and request the appropriate state to make payment. A lump sum settlement may be negotiated by the Commission between the signatories involved. The Commission is also directed to undertake water control studies in coordination with the Corps of Engineers. (Katz-Fla)
W69-07222

MUNICIPAL FLOOD AND EROSION CONTROL BOARDS.
Conn Gen Stat Ann secs 25-84 to 25-86, 25-94 to 25-98 (1960), as amended, (Supp 1969).

Descriptors: *Connecticut, *Erosion control, *Flood control, Cities, *Local governments, Cities, Legislation, State governments, Federal government, Control structures, Construction, Assessments, Construction costs, Procurement, Condemnation, Administrative agencies, Eminent domain, Legal aspects.
Identifiers: Flood control systems, Inter-agency agreements, Inter-governmental agreements.

Any municipality may adopt the provisions of this section and exercise through a flood and erosion control board the powers granted thereunder. Such board may construct and maintain a flood or erosion control system and is authorized to acquire real property for such a purpose by sale or condemnation. Construction costs may be defrayed by bond issues, special assessments, or from general taxation. A board may enter agreements with the state, the United States, or both in order to satisfy conditions for systems improving navigation or for flood protection, provided such systems are approved by the water resources commission. The state may enter such agreements through the water resources commission which shall have direct control over plans and specifications. State contracts must be approved by the attorney general. Two or more municipalities may carry out projects jointly. Local authorities may accept gifts to be applied to such projects. (Kahle-Fla)
W69-07223

CARROLL V HOPPE (RIGHT OF A RIPARIAN OWNER TO CONSTRUCT A JETTY).

123 N Y S 2d 244-246 (N Y Sup Ct 1953).

Descriptors: *New York, *Riparian rights, *Navigable waters, *Jetties, Recreation, Fishing, Swimming, Bays, Beaches, High water mark, Tides, Naviagation, Water delivery, Water supply, Recreation demand, Public rights, Permits, Cities, Public lands, Legal aspects, Judicial decisions.
Identifiers: Injunctions (Mandatory).

Plaintiff and defendant were adjoining property owners. Plaintiff brought suit to compel defendant to remove a jetty which he had constructed over the foreshore fronting of his property and extending outwards from the high water mark. Defendant had received a permit to build the jetty for the purpose of protecting the water line which conducted the fresh water supply to his property. The foreshore over which the jetty was constructed belonged to the city which had granted the permit. The court held that defendant has the right as a riparian owner to build any structure on the foreshore of his land as long as he does not interfere with the public right of navigation, access to the water for fishing, bathing and other lawful purposes to which passage over the beach may be necessary. The court stated that the plaintiff failed to show that the jetty violated the rights of the public or that the jetty constituted a nuisance or an appropriation of public lands. The court awarded judgment for the plaintiff. (Shevin-Fla)
W69-07230

KENNEBEC TOWING CO V STATE (COLLISION WITH UNDERWATER OBSTRUCTION).

52 A 2d 166-171 (Me 1947).

Descriptors: *Maine, *Bridges, *Navigable rivers, *Boats, Piers, Transportation, Damages, Channels, Channel improvement, Rivers, Tides, Abatement, Underwater, Legal aspects, Judicial decisions, Accidents, Navigation, State governments, Currents (Water).
Identifiers: *Tugboats, *Obstruction to navigation, Towing, Negligence, Barges.

Plaintiff brought this action against the state for damages suffered by plaintiff's tugboat in a collision with an alleged underwater obstruction in the draw channel of a bridge. A jury awarded damages to the plaintiff, and the state moved for a new trial. The state contended that negligence by the captain of the tug was the direct and proximate cause of the accident. The court held that plaintiff had the burden of proving by a preponderance of the evidence that the accident was caused by defendant's negligence and that it was in no way contributorily negligent. The court declared the standard to be that of the reasonable prudent man. The court held that the state had to show that the jury's verdict was so manifestly incorrect as to necessarily have been attributable to prejudice or bias. The court stated that navigable rivers are common highways and may be used as any other highway is used. It may be negligence to have a concealed obstruction in a navigable channel. The duty of a tugboat captain is to exercise reasonable care, caution, and maritime skill. The court held that all the issues in the case were contested and that the jury was in the best position to weigh the facts and render an impartial verdict. The court upheld the jury verdict for plaintiff. (Shevin-Fla)
W69-07233

LOVIN V TOWN OF HAMLET (ATTRACTIVE NUISANCE DOCTRINE APPLIED TO ARTIFICIAL LAKE).

243 N C 399, 90 SE 2d 760-764 (1956).

Descriptors: *North Carolina, *Drowning, *Recreation facilities, *Lakes, Legal aspects, Hazards, Damages, Safety, Cities, Parks, Barriers, Judicial decisions, Dams.
Identifiers: *Attractive nuisance, *Wrongful death action, *Artificial lakes, *Negligence.

Defendant municipality created an artificial lake by damming; also constructed were a public park with a playground, wading pool, and other facilities, adjacent to the lake. Plaintiff's intestate, a boy of seven years, was alleged to have been attracted to the deep water of the lake where he subsequently drowned. Plaintiff alleged that the park and unfenced lake constituted an attractive nuisance of which defendant was aware, or through due diligence should have been aware. Thus, plaintiff charged defendant municipality with negligence in an action brought under a wrongful death statute. On appeal from denial of defendant's demurrer, the Supreme Court held that the complaint failed to state a cause of action on two points: it did not allege how, where, or under what circumstances the intestate fell into the water; it did not allege that children were accustomed to wade or play in and around the lake so as to put defendant on notice. The court held it was not negligence per se to maintain an unenclosed pond. The court also held that the attractive nuisance doctrine could not be applied to the park facilities under the circumstances since no inujury occurred on the facilities. (Harris-Fla)
W69-07236

UNITED STATES V FEDERAL POWER COMMISSION (FEDERAL POWER COMMISSION AUTHORITY OVER PROJECT LICENSING).

191 F 2d 796-809 (4th Cir 1951).

Descriptors: *Federal project policy, *Federal power act, *Hydroelectric project licensing, *Flood control, Legal aspects, Dams, Federal government, Permits, North Carolina, Judicial decisions, Dam construction, Water resources development.
Identifiers: *Roanoke Rapids project, *Federal Power Commission, *Flood control act of 1944.

Petitioners (Secretary of Interior and a cooperative electric company) sought an order setting aside the grant of a license by the Federal Power Commission to a private power company to construct a dam on the Roanoke River. Petitioners contended the FPC cannot grant such a license because the Flood Control Act of 1944 removed that power from FPC control. The court of appeals held that the Secretary had no power to determine when the development of water resources should be undertaken by the United States and withheld from private companies; only Congress and its delegate, the FPC, were charged with that power. The Secretary had no authority to intervene on behalf of the United States in these matters. Under the Federal Power Act, the FPC may issue licenses and thereby regulate water development. Only when Congress expressly or impliedly removes a project from FPC jurisdiction is this power limited. The FPC approved the general Flood Control Act but did not put the project completely under federal control. The court held that the general plan was to be supplemented by discretionary licensing by the FPC--not completely relegated to United States control. (Harris-Fla)
W69-07240

UNITED STATES V GENERAL BOX CO (CONDEMNATION OF LAND FOR LEVEE PURPOSES).

224 F 2d 7-21 (5th Cir 1955).

Descriptors: *Louisiana, *Eminent domain, *Levees, *Compensation, Mississippi River, Federal government, Navigable waters, United States, Rivers, Lumber, Condemnation, Public lands, Dikes, Flood control, Administrative agencies, Judicial decisions, Riparian land, Legal aspects, Relative rights, Right-of-way, Land, Beds.
Identifiers: *Riparian servitudes.

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Plaintiff was the owner of timber located on land used by the United States to enlarge a levee on the Mississippi River. The state levee board exercised a riparian servitude to acquire the land for levee purposes and then donated the land to the United States in accordance with a state statute and the state constitution. The owners of the land were notified but plaintiff was not. The United States, through its servants, entered the land and destroyed the timber. Plaintiff brought action to recover the value of the timber. From a judgment for plaintiff in the trial court, the United States appealed. The circuit court held the United States was not liable for the timber because it had received the right-of-way from the state which had correctly appropriated the tract, without compensation, under a riparian servitude. The property was not taken by expropriation; rather, a public use was made of a public right-of-way. No notice was required to be given to plaintiff. In addition, the court found that the timber had been located on batture and that the constitution did not allow payment for destruction of batture or of timber located thereon. (Helwig-Fla)
W69-07242

GENERAL BOX CO V UNITED STATES (RECOVERABLE DAMAGES FROM LEVEE CONSTRUCTION).

107 F Supp 981-988 (W D La 1952).

Descriptors: *Louisiana, *Levees, *United States, *Eminent domain, Damages, Mississippi River, Judicial decisions, Legal aspects, Public benefits, Remedies, Riparian land, Flood control, Trees, Construction, Administrative agencies, Right-of-way, Federal government, Compensation, State governments, Condemnation.
Identifiers: Due process (Procedural).

Plaintiff owned timber land on the Mississippi River which was destroyed by defendant's enlargement of a levee on the main stream. The Fifth Louisiana Levee District had agreed, in compliance with the Flood Control Act, to obtain rights-of-way along the river for the United States. The district failed to comply with the strict guidelines of the state constitution and statutes which dealt with the procedures to be followed in taking lands for levee purposes. As provided by state statute, if the owner and the district disagree on the price to be paid for the owner's property, a trial on the issue should be held. Plaintiff disagreed as to the price to be paid for his timber, and no trial was held. Plaintiff then sought to recover the price of the timber from the federal government. The court allowed plaintiff's claim. The court based its decision on the Fifth Amendment to the Federal Constitution which prohibits the taking of property for public use without just compensation. Even though the rights-of-way were issued to the defendant by the levee district, if they were invalid, the defendant is liable. (Holt-Fla)
W69-07243

CENTRAL NEW YORK BROADCASTING CORP V STATE (SUIT TO RECOVER DAMAGES FOR NEGLIGENCE OF STATE IN FLOOD CONTROL PROJECT).

206 Misc 101, 132 N Y S 2d 12-15 (Ct Cl 1954).

Descriptors: *New York, *Flood control, *Channel improvement, *State jurisdiction, State governments, Federal government, Drainage districts, Levees, Drainage systems, Floodwater, Flood damage, Overflow, Erosion, Obstruction to flow, Water spreading, Rain, Channels, Surface runoff, Legal aspects, Judicial decisions, Flow augmentation, Construction, Excessive precipitation.

Plaintiff brought this claim to recover for damage sustained by reason of the alleged negligence of the State of New York in carrying out a flood control project. The construction of a new channel to carry water resulted in the formation of a bottleneck in the old channel. Work stopped for a time on the new channel, and when the annual spring floods came the old channel was unable to carry water as it had in the past. This resulted in an overflow of great quantities of water running at a rapid rate to a lower level. This swift running water eroded much of plaintiff's property. The court affirmed a finding that the state was negligent in its construction of the outlet from the channel. The state was held liable for damages because it owned the land used for the project, the plans for construction were defective, and the work was inherently dangerous. Furthermore, the court held that even though this was a joint venture involving the state and federal governments, the state's responsibility could not be delegated. (Logan-Fla)
W69-07244

PERKINS V PALO ALTO COUNTY (SUIT FOR INJUNCTION REQUIRING COUNTY TO CONSTRUCT A CULVERT).

60 NW 2d 562-566 (Iowa 1953).

Descriptors: *Iowa, *Watercourses (Legal), *Culverts, *Highways, Roads, Graded, Surface drainage, Surface waters, Alteration of flow, Natural streams. Ditches, Drainage systems, Floods, Local governments, Legal aspects, Judicial decisions, Remedies, Damages, Land tenure, Diversion, Road construction.
Identifiers: Injunctions (Mandatory).

Plaintiff landowner brought this suit seeking a mandatory injunction requiring defendant to put a culvert through road adjacent to plaintiff's land so as to divert water into a natural watercourse. Defendant had constructed a road which blocked the natural course of surface waters across property subsequently purchased by plaintiff and had diverted that water along a road ditch running around the property. Plaintiff's predecessor in title had requested that this ditch be constructed and acquiesced in its use. When plaintiff bought the property, he knew of the old watercourses as well as the existing ones. The court ruled that the roadside ditch had become the natural watercourse and that plaintiff was not entitled to have a culvert constructed through the road in order to divert water back into the old watercourse. The court further held that the fact that watercourse would flood plaintiff's property if debris was not removed from the channel would not support an order for construction of a culvert. (Logan-Fla)
W69-07245

UNITED STATES V DICKINSON (SUIT TO RECOVER VALUE OF LAND FLOODED BY THE FEDERAL GOVERNMENT).

331 U S 745-751 (1947).

Descriptors: *West Virginia, *Flooding, *Condemnation, *Public rights, Dams, Eminent domain, Cost repayment, Soil erosion, Damages, Flood damage, Land reclamation, Easements, Judicial decisions, United States, Federal government, Developed waters, Water resources development, Compensation, Condemnation value, Landfill.
Identifiers: Statute of limitations.

Plaintiff brought this suit to recover for the value of easements taken by the federal government. Without condemning land, the government built a dam on a river and raised the water level so as to flood a part of respondents' land. More than six years after the dam was built, but less than six years after the water reached its highest level, respondents sued for compensation. The court held that they were not barred by the six years statute of limitations. When the government chooses to take land by physical processes rather than by condemnation, the owner is not required to resort to piecemeal or premature litigation to determine what is 'taken.' The court also held that when part of a tract is taken by flooding, compensation is due for any erosion to the remaining part of the tract proximately caused by such flooding. Compensation is payable in full for the amount of land taken even if the owner later, with the consent of the government, fills the land. The court found that the landowner was entitled to compensation for an easement for intermittent flooding above the new permanent water level. (Kelly-Fla)
W69-07246

GOODYEAR TIRE AND RUBBER CO OF ALABAMA, INC V GADSDEN SAND AND GRAVEL CO, INC (UNDERSEEPAGE AND WATER FLOWAGE).

27 So 2d 578-584 (Ala 1946).

Descriptors: *Alabama, *Repulsion (Legal aspects), *Riddance (Legal aspects), *Damages, Remedies, Percolation, Seepage, Underseepage, Underflow, Subsurface drainage, Soil moisture, Percolating water, Dams, Hydraulic structures, Mineral industry, Industrial water, Impounded waters, Ponds, Surface waters, Reservoirs, Flooding, Judicial decisions, Legal aspects, Easements, Prescriptive rights, Rainfall, Sands, Natural flow.
Identifiers: Statute of limitations.

Plaintiff brought this action against the owner of adjacent servient property for damages resulting from defendant's blockage of the natural flow of surface waters from plaintiff's land and for damages resulting from impoundment of water on defendant's land. Defendant built a dam on lands adjoining plaintiff's land. The dam prevented the natural flow of water from plaintiff's land and caused the saturation of the moulding sand located on plaintiff's property. The court held that the claim arising from blockage of the surface water flow was barred by the statute of limitations but held the allegations concerning impoundment of waters on defendant's property by construction of a dam constituted a cause of action for private nuisance. The court noted that the evidence disclosed that the nuisance arose from the maintenance of the dam, not its construction, and that, under Alabama law, damages for nuisance predicated on negligent maintenance are awarded as though the nuisance were abatable. The court therefore awarded damages only for the temporary injury caused plaintiff and not for any prospective damages. (Katz-Fla)
W69-07248

BURLEYSON V WESTERN AND ATLANTIC RR (OVERFLOW AS AN ABATABLE NUISANCE).

91 Ga App 745, 87 SE 2d 166-171 (1955).

Descriptors: *Georgia, *Overflow, *Culverts, *Remedies, Rainfall, Rainfall-runoff relationships, Damages, Judicial decisions, Flooding, Ditches, Depreciation, Railroads, Legal aspects.
Identifiers: *Nuisance (Abatable).

Plaintiff sought recovery for damage to his land allegedly caused by an inadequate drainage culvert maintained by defendant railroad. In times of heavy rain the culvert overflowed causing erosion on the land and thus depreciated the rental value of the land. The appellate court sustained the trial court's finding that plaintiff was not entitled to recovery for permanent damages, since the overflow constituted an abatable nuisance and plaintiff could not assume that the condition would continue indefinitely. The proper remedy should have been to bring from time to time separate suits for recurring injury. The measure of damages for continuing abatable nuisance is diminution of rental value during existence of the nuisance and not diminution in market value of the property. (Kahle-Fla)
W69-07249

GOUGH V GOBLE (OBSTRUCTION TO FLOW OF SURFACE WATER).

2 Ill 2d 577, 119 NE 2d 252-254 (1954).

Descriptors: *Illinois, *Obstruction to flow, *Surface waters, *Surface drainage, Floodwater, Surface runoff, Drainage water, Channels, Canals, Gullies, Judicial decisions, Water law, Legal aspects, Alteration of flow, Relative rights, Culverts, Barriers, Natural flow.

Plaintiff was awarded a mandatory injunction to compel defendants to remove an obstruction from their land which allegedly impeded the natural flow of water from plaintiff's land. When for more than forty years surface waters from an upper landowner's realty had passed through a culvert and flowed onto the lower landowner's land at a level two feet lower than the general surrounding ground, the lower landowner had no right to obstruct the culvert and to impede the flow of water, even though the landowner was merely restoring to its natural level land which had been lowered over the course of years by action of water from the culvert. (Dean-Fla)
W69-07251

STATE V GEORGE C STAFFORD AND SONS (BOUNDARY DISPUTE OVER FILLED IN LAKE SHORE).
105 A 2d 569-575 (N H 1954).

Descriptors: *New Hampshire, *Boundary disputes, *Land tenure, *Littoral, Riparian rights, Lakes, Great ponds, Equitable apportionment, Shores, Judicial decisions, Landfills, Land forming, Highway effects, High water mark, Legal aspects, Reasonable use, Legislation, Administrative agencies, Ownership of beds, State governments.
Identifiers: Estoppel.

While constructing a highway, the state extended the shoreline of a lake by filling in part of the bed. The fill was placed, with defendant's permission, adjacent to the shore bordering defendant's land. After the highway commissioner agreed that defendant would receive title to the filled land, defendant made improvements and added a wharf, all of which brought public complaints. The state filed this bill in equity to determine the boundary line between the state's and defendant's lands, and to remove the cloud from the state's title. The appellate court held defendant had no title since the commission lacked authority to grant it, and that the state, by statute, could not lose rights through estoppel. The court ruled a littoral owner may acquire land by filling in the shore only through legislative sanction, since beds of great ponds and lakes are held in trust by the state for the public. Furthermore, the court held the right to build wharves must be exercised reasonably so as to protect public interests, and allowed the lower court alternative to an equitable solution. (Wheeler-Fla)
W69-07252

STUART V LAKE WASHINGTON REALTY CORP (ACTION TO ENJOIN FLOODING OF PROPERTY BY RAISING LAKE LEVEL).

92 SE 2d 891-909 (Sup Ct App W Va 1956).

Descriptors: *West Virginia, *Dams, *Backwater, *Flood damage, Relative rights, High water mark, Design flood, Flooding, Land tenure, Easements, Judicial decisions, Legal aspects, Lakes, Lake shores, Impoundments, Water levels, Contracts.
Identifiers: Injunctions (Mandatory), Injunctions (Prohibitory), Estoppel, Balance of convenience.

Plaintiffs sued to enjoin defendant realty corporation from further flooding their lakefront property and to compel defendant to remove impounded waters. Plaintiffs contended the inundation resulted when defendant raised the lake's elevation by increasing the height of defendant's dam. The man-made lake was part of defendant's housing development, from which plaintiffs' land had been withheld. Defendant urged the use of the balancing of convenience doctrine, since lowering the lake level would reduce the value of the development, and would cause breaches of contract already made with lot purchasers. Defendant alternately claimed an implied easement to flood plaintiffs' land. The appellate court found that an implied easement must have been within the intention of the parties when conveyance was made, and that it must have been mentioned in the deed, or have been apparent, continuous, and necessary for the enjoyment of the land retained. In the instant case, no easement was mentioned in the deed nor was apparent in fact. The court further found that relative inconvenience to each party would not be balanced where the non-wrongdoing party would suffer substantial and irreparable injury, even though the wrongdoer will suffer greater injury. (Kelly-Fla)
W69-07260

4C. Effects on Water of Man's Non-Water Activities

LAIRD, ROCK AND SMALL, INC V HARRY T CAMPBELL AND SONS (FLOODING DUE TO NEGLIGENT ROAD CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W69-07021

VENTURA V CITY OF PITTSBURGH (ACCIDENT CAUSED BY ICE FORMING ON A HIGHWAY).
For primary bibliographic entry see Field 06E.
W69-07022

STRICKLAND V STATE (HIGHWAY CONSTRUCTION AND SURFACE WATER DRAINAGE).
For primary bibliographic entry see Field 06E.
W69-07042

CITIZENS COMM FOR HUDSON VALLEY V VOLPE (WAIVER OF THE DEFENSE OF SOVEREIGN IMMUNITY).

297 F Supp 809-814 (S D N Y 1969).

Descriptors: *New York, *United States, *State governments, *Hudson River, Streams, Surface waters, Highways, Roadbanks, Road construction, Landfills, Dams, Bridges, Transportation, Embankments, Scenic highways, Adjudication procedure, Legal aspects, Judicial decisions, Highway effects, Environmental effects, Damages, Remedies, Federal government, Engineering structures.

Plaintiffs brought this action against the state Commissioner of Transportation challenging the construction of the Hudson River Expressway. The defendant obtained permission from the federal government to construct the road. Permission was admittedly required since the proposed expressway would extend into and over the River. The plaintiffs' contended that the defendant had waived the defense of sovereign immunity in federal court by knowingly entering an area regulated by Congress pursuant to constitutional authority. The court held that this limitation on the defense of sovereign immunity only applied where a state had entered a sphere of operation subject to causes of action created by Congress in favor of a specific class (FELA claims). The plaintiffs in this case did not bring its action under a statute requiring a person to secure a federal permit prior to alteration of a navigable stream. Therefore, the defendant had not waived the defense of sovereign immuntity to an action at law. However, when a state official attempts to proceed under a statute claimed to be unconstitutional, he is stripped of his official character and may be enjoined from proceeding. (Katz-Fla)
W69-07195

CITIZENS COMM FOR THE HUDSON VALLEY V VOLPE (PRELIM INJUNCTION BARRING HIGHWAY CONSTRUCTION ALONG A NAVIGABLE STREAM).
297 F Supp 804-808 (S D N Y 1969).

Descriptors: *New York, *United States, *State governments, *Highways, Hudson River, Streams, Surface waters, Roadbanks, Road construction, Landfill, Dams, Bridges, Transportation, Embankments, Scenic highways, Adjudication procedure, Legal aspects, Judicial decisions, Highway effects, Environmental effects, Damages, Remedies, Federal government, Engineering structures.
Identifiers: Prereq for prelim injunction.

Plaintiffs applied for a preliminary injunction prohibiting the delivery of a permit authorizing the State of New York to begin landfill operations on the proposed Hudson River Expressway. The court held that the plaintiff had failed to demonstrate a reasonable probability of success at trial challenging the construction of the expressway. The court noted that the items of damage claimed by the plaintiff were highly conjectural and that adequate remedy at law existed. Further delay in commencement of construction would increase the project's cost. Therefore, the court denied the plaintiff's application. The plaintiff had contended that the expressway project was incorrectly treated by the Army and Interior departments as one requiring a mere permit. The plaintiffs argued that the project called for construction of dikes and causeways and therefore required consent of Congress. The court noted that the project would not substantially interfere with navigation and determined that plaintiffs' argument in this regard would be of no avail. (Katz-Fla)
W69-07196

IN RE APPROPRIATION OF EASEMENTS FOR HIGHWAY PURPOSES (COMPENSATION FOR DAMAGES CAUSED BY TAKING UNDER EMINENT DOMAIN).

163 NE 2d 181-186 (Ohio Ct App 1958).

Descriptors: *Ohio, *Eminent domain, *Subsurface waters, *Damages, Compensation, Easements, Springs, Underground streams, State governments, Administrative agencies, Groundwater movement, Highways, Road construction, Legal aspects, Judicial decisions, Condemnation.
Identifiers: *Underground reservoirs, *Adjacent landowners.

The Director of Highways instituted proceedings to acquire an easement through a tract of land on which several completed houses of a project were located. It appeared from the evidence that the excavation would release the water from a natural underground reservoir and cut off the only source of water available to the houses in the project. The court of appeals in affirming a judgment in the trial court appealed from by the Director held the governmental right of eminent domain was not analogous to that of an adjacent landowner, who can legally drill for water even at the risk of impairing his neighbor's supply. The requirement to compensate for a taking under eminent domain is absolute, regardless of forseeability. If the state is called upon to pay high damages, it may choose not to take. The court held compensation must extend to damage to adjacent property as well as that under the easement. The court further held evidence of rents paid on completed houses to be admissible as an element of fair market value. Finally, the court felt the resolutions and findings of the Director of Highways was admissible in evidence to help establish compensation. (Harris-Fla)
W69-07212

PERSIN V CITY OF YOUNGSTOWN (FLOODING OF LOWER TRACT DUE TO AIRPORT CONSTRUCTION).

92 NE 2d 237-244 (Ct App Ohio 1949).

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Descriptors: *Ohio, *Surface waters, *Surface drainage, *Obstructions to flow, Floodwater, Surface runoff, Flooding, Drainage water, Drainage, Floods, Water law, Judicial decisions, Legal aspects, Snowmelt, Airports, Flow augmentation, Diversion, Alteration of flow, Reasonable use, Natural flow, Rainfall-runoff relationships, Relative rights, Cities, Construction.

Plaintiff brought action against defendant city for damages resulting from defendant's construction of an airport which allegedly diverted surface water from its natural course, accelerating and increasing the flow and causing flooding of plaintiff's land. A lower tenement is burdened with a servitude to receive all surface water accumulating from falling rain, melting snow or from natural springs that naturally flow from higher land onto the lower tract. The construction of an airport by the defendant city amounted to rightful and reasonable use of its land, and there was no evidence which demonstrated a direct causal connection between the construction of the airport and the flooding of plaintiff's land. The judgment for defendant was affirmed. (Dean-Fla)
W69-07250

FLANAGAN V GREGORY AND POOLE INC (UPSTREAM RIGHTS IN RE FLOW).
67 SE 2d 865-874 (W Va 1951).

Descriptors: *West Virginia, *Roadbanks, *Repulsion (Legal aspects), *Culverts, Streams, Riddance (Legal aspects), Real property, Natural flow, Obstruction to flow, Downstream, Coal mines, Strip mines, Judicial decisions, Legal aspects, Hydraulic structures, Dams.

Plaintiff sued the defendant corporation and the corporation's lessor for damage to plaintiff's land and buildings caused by flooding. The damage was caused by defendant corporation's erection and maintenance of an embankment for a roadway across the valley of a creek below plaintiff's land and an inadequate drainage culvert under such a roadway. The court, in passing on the propriety of the lessor's joinder, held that a landowner who permits a lessee to erect such a roadway and an inadequate culvert in a manner which impedes the flow of a stream is liable as a codefendant if the lessor acted in concert with the lessee. The court determined that the lessor leased the property to the lessee for the purposes of strip mining coal in pursuit of a common interest and upheld the joinder. (Katz-Fla)
W69-07254

COUSIN V HORNSBY (LANDOWNER IS RESTRICTED TO ACTION FOR DAMAGES ONCE RIGHT TO RESIST EXPROPRIATION IS WAIVED).
87 So 2d 157-163 (Ct App La 1956).

Descriptors: *Louisiana, *Appropriation, *Right-of-way, *Channel improvement, Judicial decisions, Preferences (Water rights), Priorities, Eminent domain, Damages, Value, Condemnation value, Land appraisal, Local governments, Contracts, Legal aspects.

Plaintiff sued defendant contractor for trespass and related damages to his land, trees, and flowing springs resulting from a contractor's dredging. The contractor was under contract to a subdivision of the State Public Works Dept to construct a drainage project. The state was to obtain rights-of-way prior to entry upon the land by the contractor. No right-of-way was ever obtained over the plaintiff's land, but information of this was not conveyed personally to the contractor, who entered upon the land and began work. The state authorities claimed that the contractor was liable for all damage caused by his own acts or omissions. The state claimed that the defendant had been notified of the lack of appropriation through one of his own agents. This court amended and affirmed a decision for the plaintiff. The state should reimburse the defendant for any judgments already paid to the plaintiff since it was the state which contracted for the work the contractor faithfully performed. The plaintiff knew his land was to be taken as part of the project yet did not sue until work was completed. By acquiescing in the taking of his land, and by not seeking injunctive relief before the damage was done, the plaintiff is now able to bring merely an action to recover the value of the land taken and damages to adjacent property. Blunt-Fla)
W69-07255

ORTEGO V CALDWELL (ACTION FOR DAMAGES DUE TO CROP FLOODING RESULTING FROM DEFECTIVE LEVEE).
87 So 2d 124-127 (La 1956).

Descriptors: *Louisiana, *Levees, *Earthworks, *Highway relocation, Judicial decisions, Damages, Flooding, Flood protection, Flood damage, Cost repayment, Standards, Road construction, Legal aspects, Contracts, Projects, Rain water, Surface runoff.
Identifiers: Agency, Independent contractors.

Plaintiffs brought this action for damages against defendant contractor alleging that defendant had improperly constructed a levee designed to prevent flooding of plaintiffs' land and crops via drainage from an adjoining highway. Plaintiff had permitted the state department of highways to destroy an old levee on plaintiffs' land in order to widen an adjoining highway. In return, the department had promised construction of a new levee to be built to the plaintiffs' satisfaction. Defendant contractor improperly constructed the levee so that several breaks occurred during heavy rains, resulting in crop damage to plaintiffs. The court permitted plaintiffs to sue defendant, as an independent contractor of the state, on the contract clause guaranteeing satisfaction. The court permitted a finding of liability in spite of the agency relationship with the state, holding that the state had not actually approved defendant's work. (Kelly-Fla)
W69-07262

GINTHER V LONG (ACTION FOR DAMAGES DUE TO TEMPORARY POLLUTION OF SOIL, RESULTING IN TIMBER LOSS).

87 So 2d 286-289 (Miss 1956).

Descriptors: *Mississippi, *Soil contamination, *Oil wastes, *Property values, Effluents, Compensation, Damages, Depreciation, Timber, Fouling, Judicial decisions, Legal aspects, Water pollution, Oil wells, Waste water (Pollution).

Appellee landowner brought suit for damages to his land and timber, alleging this resulted because appellant permitted deleterious effluents to flow on appellee's land from appellant's oil well, which operated on adjacent land. The state Supreme Court upheld appellee's claim, finding that salt water and oil from appellant's oil well operation caused injury to appellee's land and timber. The court held that appellant's certificate of compliance to the pollution regulations of the Fish and Game Commission was inadmissible as evidence of nonpollution, since it was issued after appellee's claim had matured. The court found, however, that appellee had been awarded excessive damages, because the pollution had caused temporary rather than permanent injury. The measure of damages in Mississippi for temporary injury is the depreciation in rental value of the property, not the depreciation in its market value. (Kelly-Fla)
W69-07263

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

DETERMINATION OF NITRATE IN ESTUARINE WATERS--COMPARISON OF A HYDRAZINE REDUCTION AND A BRUCINE PROCEDURE AND MODIFICATION OF A BRUCINE PROCEDURE,
Federal Water Pollution Control Administration, Metuchen, N. J. Hudson-Champlain and Metropotitan Coastal Comprehensive Water Pollution Control Project.
For primary bibliographic entry see Field 02L.
W69-06861

PROVISIONAL ALGAL ASSAY PROCEDURE,
Joint Industry-Government Task Force on Eutrophication, New York.
G. P. Fitzgerald, Joseph Shapiro, C. R. Goldman, O. R. Armstrong, and Jack Myers.
Published by Joint Industry/Government Task Force on Eutrophication, P O Box 3011, Grand Central Station, New York, 62 pp, Feb 1969. 7 fig, 5 tab, 26 ref.

Descriptors: *Algae, *Bioassay, Nutrients, Eutrophication, Water pollution effects, Water pollution sources, Bioindicators, Nitrogen fixation.
Identifiers: *Algal growth, Nutrient availability, Algal growth potential, Selenastrum capricornutum, Anabaena flos-aquae, Microcystis aeruginosa, Algal cultures, Chemostats, Carbon-14.

The procedure described was developed by a team of international experts under the sponsorship of the Joint Industry/Government Task Force on Eutrophication and represents the first step toward developing reliable and reproducible tests to determine the capacity of various aquatic environments to grow algae. It is emphasized that the procedures presented are provisional and are not standardized tests. Three procedures are described: a bottle test, a continuous-flow chemostat test, and an in situ test. Detailed descriptions of equipment required, laboratory procedures, analytical techniques, and sample preparation are given. Indicator organisms selected for use in the tests are Selenastrum capricornutum, a green alga; Anabaena flos-aquae, a blue-green alga capable of fixing nitrogen; and Microcystis aeruginosa, a blue-green alga not capable of fixing nitrogen. (Uttormark-Wis)
W69-06864

MICROORGANIC MATTER IN WATER,
Carnegic-Mellon Univ., Pittsburgh, Pa.
R. A. Baker.
ASTM STP No 448, Symp on Microorganic Matter in Water, Amer Soc Testing Mater 71st Annu Meeting, June 23-28, 1968, San Francisco, Feb 1969. 124 p, 43 fig, 27 tab, 205 ref.

Descriptors: *Organic matter, *Microorganism, *Water chemistry, Analytical techniques, Pesticides, Phenols, Chromatography, Fluormetry, Trace elements.
Identifiers: *Symposia.

A symposium was held to discuss organic contaminants in water, with emphasis on microorganisms, pesticides, and analytical techniques. Topics of papers include nitrogen uptake, pesticide analysis, freeze concentration of microorganics for analysis, thin-layer chromatography to identify phenols, fluorescence techniques, and determination of trace amounts of molybdenum. (Knapp - USGS)
W69-06968

MICROBES AND MICROORGANICS IN WATER - A REVIEW,
Koppers Co., Inc., Monroeville, Pa. Dept. of Research.
For primary bibliographic entry see Field 05G.
W69-06969

ANALYSIS FOR ORGANIC PESTICIDES IN AQUATIC ENVIRONMENTS,
Rutgers - The State Univ., New Brunswick, N. J. Dept. of Environmental Sciences; Rutgers - The State Univ., New Brunswick, N. J. Bureau of Conservation; and Drexel Inst. of Tech., Philadelphia, Pa.
S. D. Faust, and I. H. Suffet.
Res supported by grant from USPHS. ASTM STP No. 448, Symp on Microorganic Matter in Water, Amer Soc Testing Mater 71st Annu Meeting, June 23-28, 1968, San Francisco, pp 24-64, Feb 1969. 41 p, 7 fig, 18 tab, 87 ref. Grant No. ES-00016 PHS.

Descriptors: *Chemical analysis, *Pesticides, *Analytical techniques, Chromatography, Gas chromatography, Aromatic compounds, Organic compounds, Organophosphorus pesticides, Photometry.
Identifiers: Pesticide analysis.

The detection of organic pesticides in aquatic environments is unique in that specificity is required under extremely sensitive conditions as opposed to gross analysis for trace organics in water. First, there is the problem of pesticide identification. Second, direct measurement is not feasible because of sensitivity and specificity requirements. Extraction, concentration, and cleanup techniques must be employed prior to qualitative analysis and quantification. Third, natural waters may contain such organic interferences as aromatic and aliphatic compounds from industrial waste waters, and naturally occurring colored compounds. These impurities are often present in concentrations greater than the pesticide. A brief critique of extraction, cleanup, identification, and quantification techniques is given to emphasize limitations, fallacies, and pitfalls. A model system is outlined for the recovery, separation, and confirmation of organophosphate pesticides, oxons, and their hydrolysis products. This model system provides by liquid-liquid extraction, separation by gas-liquid chromatography, and subsequent confirmation by micro-ultraviolet absorption spectrophotometry are discussed. (For main entry see W69-06968.)
W69-06971

DETERMINATION OF PHENOLS IN SURFACE WATERS BY THIN-LAYER CHROMATOGRAPHY,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Branch.
Doris Smith, and J. J. Lichtenberg.
ASTM STP No 448, Symp on Microorganic Matter in Water, Aner Soc Testing Mater 71st Annu Meeting, June 23-28, 1968, San Francisco, pp 78-95, Feb 1969. 18 p, 9 fig, 5 tab, 29 ref, 1 append.

Descriptors: *Analytical techniques, *Phenols, *Chemical analysis, *Chromatography, Water pollution, Pollutants, Pollutant identification, Surface waters.
Identifiers: *Thin-layer chromatography.

Thin-layer chromatographic procedures for the determination of phenol and certain substituted phenols are applied to raw surface waters. Both water grab and carbon adsorption samples are analyzed. The concentrated solvent extracts of the samples are chromatographed on silica gel G thin layers and developed in benzene/cyclohexane/diethylamine (5:4:1) or chloroform. The first system provides for selective determination of the alkylphenols, since the chloro-, nitro- and aminophenols remain at or near the origin. Phenols developed with this system are detected with p-nitrobenzendiazonium, fluoroborate. Those developed with chloroform are detected with Gibbs' reagent. Specific phenols are characterized by their Rf values and the color of the spots produced. A wide variety of phenols are detected at the 0.1 to 10 microgram level with the Gibbs' reagent and at the 0.5 microgram level with p-nitrobenzenediazonium fluoroborate. (For main entry see W69-06968.)
W69-06972

FLUORESCENCE TECHNIQUES IN DETECTION OF ORGANICS IN WATER,
Washington Univ., Seattle. Dept. of Chemistry; and Washington State Water Pollution Control Commission.
R. F. Christman, and J. L. Arnquist.
ASTM STP No 448, Symp on Microorganic Matter in Water, Amer Soc Testing Mater 71st Annu Meeting, June 23-28, 1968, San Francisco, pp 96-115, Feb 1969. 20 p, 14 fig, 1 tab, 14 ref.

Descriptors: *Analytical techniques, *Chemical analysis, *Organic matter, *Aqueous solutions, *Fluorometry, Fluorescence, Color, Water quality, Water pollution effects.
Identifiers: Water color, Flavonoids.

The fundamental objective of the authors' continuing research in this area is to increase our understanding of the chemical structures of natural product organic molecules responsible for color in natural water and the mechanism of their interaction with salts of trivalent Al and trivalent Fe. Previous research has resulted in the isolation and identification of seven aromatic oxidation products of the parent color producing macromolecules. In this paper the research results of interaction studies using model flavonoid compounds and controlled concentrations of coagulant metal ions, alkalinity, and ionic strength are presented. (For main entry see W69-06968.)
W69-06973

DETERMINATION OF TRACE AMOUNTS OF MOLYBDENUM,
California Univ., Davis. Inst. of Ecology.
Richard Armstrong, and C. R. Goldman.
ASTM STP No 448, Symp on Microorganic Matter in Water, Amer Soc Testing Mater 71st Annu Meeting, June 23-28, 1968, San Francisco, pp 116-124, Feb 1969. 9 p, 16 ref. NSF Grant GB6422X USPHS WP 01188-01.

Descriptors: *Analytical techniques, *Chemical analysis, *Molybdenum, *Nutrients, Trace elements, Chemical precipitation, Organic compounds, Spectrophotometry.
Identifiers: Micronutrients, Trace metals, Coprecipitation.

Molybdenum is determined directly in solutions containing above 100 ppb. A spectrophotometric method using the extractable complex with diacetyldithiol was found to be the most convenient and the least subject to interference of a number of methods. Preconcentration of dissolved molybdenum by coprecipitation with hydrated manganese dioxide followed by spectrophotometry of the dithiol complex allows the determination of 1 microgram of molybdenum in a 5-liter sample (o.2ppb) with a relative error of 3%. Particulate matter may be removed from water samples by HA Millipore filtration or by continuous flow (150 ml/min) centrifugation at 28,000 g. The latter method is more convenient for processing the large (10L to 50L) water samples needed for estimating the trace metal content of suspended particles in unpolluted waters. Molybdenum is most conveniently released from organic materials by wet oxidation with perchloric acid, the residue being taken up in 3-N hydrochloric acid. Hydrofluoric acid digests of silicate samples were found to give higher recoveries than perchloric acid digests and were found to be more reproducible than fusion methods. (For main entry see W69-06968.)
W69-06974

IMPORTANCE OF THE BOD PLATEAU,
California Univ., Davis.
For primary bibliographic entry see Field 05B.
W69-06980

DETERMINATION OF DISSOLVED HYDROCARBONS IN SUBSURFACE BRINES,
Chevron Research Company, La Habra, Calif.
Clayton McAuliffe.
Proc of Symp on Geochem of Subsurface Brines, Kansas Univ, Mar 25-26, 1968. Chem Geol, Vol 4, No 1-2, pp 225-233, Mar 1969. 9 p, 4 fig, 3 tab, 11 ref.

Descriptors: *Water chemistry, *Analytical techniques, *Chemical analysis, *Organic compounds, Brines, Saline water systems, Saline water, Solutes, Ions, Alcohols, Aromatic compounds, Chromatography, Solubility, Gas chromatography.
Identifiers: *Hydrocarbons.

Hydrocarbons dissolved in subsurface waters can be determined by several analytical procedures. The method selected should depend upon the hydrocarbons of interest and the sensitivity required. These methods provide techniques that can be used as an aid in petroleum exploration, and provide information to help answer questions concerning petroleum origin, migration, and accumulation. Proper percautions must be taken to minimize hydrocarbon loss during sample collection, storage, and analysis. The solubility of hydrocarbons in water varies as much as 5-6 orders of magnitude, depending upon the hydrocarbon type and molecular weight within a homologous series. The concentration of dissolved hydrocarbons in subsurface brines varies widely from brine to brine. Marked variations also occur in the relative concentrations of the individual hydrocarbons dissolved.
W69-07101

AERIAL PHOTOGRAPHIC TECHNIQUES IN POLLUTION DETECTION,
Wisconsin Univ., Madison. Dept. of Civil Engineering; and Itek Corp., Lexington, Mass. Photogrammetry Dept.
James P. Scherz, William C. Boyle, and Donald R. Graff.
See also W69-07110. Proc of 23rd Ind Waste Conf, May 7-9, 1968, Purdue Univ, Part 1, pp 87-100, 1969. 14 p, 17 fig, 26 ref.

Descriptors: *Aerial photography, *Water pollution control, *Remote sensing, Spectrophotometry, Infrared radiation, Photogrammetry, Photometry, Tracking techniques, Pollutant identification.
Identifiers: Infrared photography, Pollution photography.

Aerial photography may be used to identify various pollutants and to estimate dissolved oxygen and algal growth. Reflection characteristics of wastes are studied by spectrophotometry and shown graphically. Secondary effects, such as foaming where heated wastes enter bodies of water, are shown better by proper film-filter combinations than seen by the eye. (Knapp-USGS)
W69-07111

5B. Sources of Pollution

A CHEMICAL INDEX OF SOIL NITROGEN AVAILABILITY,
Iowa State Univ., Ames. Dept. of Agronomy.
D. R. Keeney, and J. M. Bremner.
Nature, Vol 211, No 5051, pp 892-893, Aug 1966. 1 tab, 6 ref.

Descriptors: *Cycling nutrients, Chemical analysis, Eutrophication, Water pollution sources, Soils, Sediments, Nitrogen compounds.
Identifiers: *Soil nitrogen availability, Steam distillation procedure, Kjeldahl procedures.

A chemical method of obtaining an index of soil nitrogen availability is described and compared

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with three other chemical methods and two biological procedures. The proposed procedure involves extraction of 5 grams of soil with 30 milliliters of boiling water and determination of the extracted nitrogen by a steam distillation procedure. The procedure correlated well with the two incubation procedures and provided a rapid, reliable determination of soil nitrogen availability. (Konrad-Wis)
W69-06860

NUTRIENT REGENERATION AND PREFORMED NUTRIENTS OFF OREGON,
For primary bibliographic entry see Field 02K.
W69-06862

POLLUTION AND OBSTRUCTION OF WATERS.
For primary bibliographic entry see Field 06E.
W69-06887

MADISON METROPOLITAN SEWERAGE DIST V COMM ON WATER POLLUTION (DISCHARGE OF SEWAGE INTO LAKE WATER).
For primary bibliographic entry see Field 06E.
W69-06909

ENDRIN IN WATER FROM TREATED DOUGLAS FIR SEED,
Federal Water Pollution Control Administration, Corvallis, Oreg. Pacific Northwest Water Lab.
Richard B. Marston, Robert M. Tyo, and Stephen C. Middendorff.
Pesticides Monit J, Vol 2, No 4, pp 167-171, Mar 1969. 5 p, 4 fig, 2 tab, 2 ref.

Descriptors: *Pesticides, *Pesticide kinetics, *Water pollution sources, *Endrin, *Oregon, Pesticide drift, Pesticide residues, Water chemistry, Leaching, Translocation, Path of pollutants, Streamflow.
Identifiers: Alsea River (Oreg), Seed treatment residues.

Reseeding a 175-acre 'clear-cut' watershed in the headwaters of the Alsea River near Salado, Oreg., on January 23, 1967, followed the conventional practice of aerially broadcasting endrin-coated Douglas fir seed. Measurable amounts of endrin were detected in the streamflow for 2 hours after seeding started and again during the high flow of a winter freshet that occurred the sixth day after seeding. The total amount of endrin found in these two periods of runoff amounted to only 0.006 lb per square mile, or 0.12% of the endrin used to treat the seed. This was much lower than the results obtained in the laboratory (11.3%) from soaking endrin-treated seed in distilled water for 32 days.
W69-06947

DISTRIBUTION OF DIELDRIN AND DDT CRANBERRY BOG SOIL,
Massachusetts Univ., East Wareham. Cranberry Experiment Station.
K. H. Deubert and B. M. Zuckerman.
Pesticides Monit J, Vol 2, No 4, pp 172-175, Mar 1969. 4 p, 1 fig, 2 tab, 6 ref. Water Resources Grant WR-10.

Descriptors: *Pesticide residues, *Bogs, *DDT, *Dieldrin, *Path of pollutants, *Pesticide kinetics, Leaching, Translocation, Streamflow, Cranberries, Soil contamination, Water pollution sources, Adsorption, Organic matter, Soils.
Identifiers: Cranberry bogs.

Relatively large amounts of dieldrin, averaging 1.18 ppm and large amounts of DDT residues, averaging 3.57 ppm, 13 years after the last application were found in the top 2 inches of cranberry bog soil. Horizontal movement of the residues is favored by the movement of floodwater. In view of the possibility that dieldrin residues in cranberry bogs may contribute to water pollution, a leaching experiment was carried out. Chromatographic columns were filled with washed Standard Sand 20-30 until a 1-inch layer was obtained. A 2-inch layer of 2-mm air dry bog soil containing 2.3 ppm dieldrin was added and covered with 1 inch of sand. Distilled water was added at a rate of 2 ml/min, and the first 250 ml of eluate was analyzed for dieldrin. The eluate was not analyzed for organic colloids as carriers of dieldrin, although there are indication that dieldrin is bound to organic colloids by physical forces. The 250 ml of water removed 0.19 of the 42.5 micrograms of dieldrin contained in the bog soil. Under natural conditions water that is drawn off a bog has come in contact with the soil surface only. On the bog the residues may move with the floodwater, as the distribution of DDT in Bog 1 and the dieldrin residues in the irrigation ditches of Bog 2 indicate. Sprinkler irrigation instead of flooding appears to be a promising measure to keep the horizontal movement of these and probably other residues at a minimum.
W69-06948

INTERACTION OF PESTICIDES WITH NATURAL ORGANIC MATERIAL,
Geological Survey, Denver, Colo.
R. L. Wershaw, P. J. Burcar, and M. C. Goldberg.
Environ Sci and Technol, Vol 3, No 3, pp 271-273, Mar 1969. 3 p, 3 fig, 1 tab, 9 ref.

Descriptors: *Pesticide kinetics, *Sorption, *Solubility, *Humic acids, DDT, 2, 4, 5-T, Leaching, Persistence, Pesticide residues, Soil, Soil chemical properties.
Identifiers: Pesticide solubilization.

Sodium humate solubilizes DDT and humic acid strongly sorbs 2, 4, 5-T. The solubility of DDT in 0.5% sodium humate solution is at least 20 times its solubility in pure water. Solutions of 2,4,5-T of .0000121 g/ml and 0.1 N NaCl were mixed with humic acid. Adsorption data are shown graphically. Ion exchange may play a part in this sorption. (Knapp-USGS)
W69-06949

MICROORGANIC MATTER IN WATER,
Carnegic-Mellon Univ., Pittsburgh, Pa.
For primary bibliographic entry see Field 05A.
W69-06968

UPTAKE AND ASSIMILATION OF NITROGEN IN MICROECOLOGICAL SYSTEMS,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 05C.
W69-06970

GROUND-WATER POLLUTION FROM NATURAL GAS AND OIL PRODUCTION IN NEW YORK,
Geological Survey, Albany, N. Y.
Leslie J. Crain.
N Y State Water Resources Comm Rep of Invest No RI-5, 1969. 15 p, 8 fig, 10 ref.

Descriptors: *Water pollution, *Oil fields, *Groundwater, *New York, Oil wastes, Oily water, Saline water, Water wells, Aquifers.
Identifiers: Groundwater pollution (N Y).

Natural gas is produced throughout the central and western part of New York, whereas oil production has been limited mainly to Alleghany and Cattaraugus Counties. Ground-water pollution resulting from leakage of natural gas wells is in the form of salt water or gas. Such pollution is usually very local and is usually difficult to separate from natural contamination. Oil production, particularly the secondary recovery of oil by the water-flooding method, has resulted in the pollution of ground- and surface-water supplies with oil and salt water. Pollution from active oil fields has been caused by separator units that dispose their wastes on the ground, and by leakage and spillage from wells. Pollution in abandoned fields is usually caused by the upward movement of oil and salt water, under artesian pressure, through uncapped or leaking wells. The problems of oil pollution are expected to increase in the future as other areas in the oil fields become populated or are developed for sources of water supply. Pollution from abandoned fields especially is expected to increase. (USGS)
W69-06975

A SPECIAL CASE, THERMAL DIGITAL SIMULATION OF WASTE HEAT DISCHARGES,
Battelle Memorial Inst., Richland, Wash.; and Computer Sciences Corp., Richland, Wash.
For primary bibliographic entry see Field 05C.
W69-06979

IMPORTANCE OF THE BOD PLATEAU,
California Univ., Davis.
E. D. Schroeder.
Water Res, Vol 2 No 11, pp 803-809, Nov 1968. 7 p, 2 fig, 4 tab, 17 ref.

Descriptors: *Biochemical oxygen demand, *Laboratory tests, Biochemistry, Bacteria, Biodegradation, Sludge digestion, Aquatic microbiology, Dissolved oxygen, Indicators, Organic matter, Oxygen sag.
Identifiers: Substrate removal (Bacterial).

Laboratory experiments show that 5-day BOD, 24-hr BOD, or any other timed determination is not reproducible or significant, but that BOD reaches reproducible plateau values if allowed to react long enough. Oxygen demand is not a function of time in the strict sense, but the plateau value is formed when bacteria remove the substrate, and occurs at any time depending on the number and physiological state of the initial bacteria content. (Knapp-USGS)
W69-06980

OPTIMAL RELEASE SEQUENCES FOR WATER QUALITY CONTROL IN MULTIPLE-RESERVOIR SYSTEMS,
Michigan Univ., Ann Arbor.
For primary bibliographic entry see Field 05G.
W69-06982

CONTRACTS FOR ABATEMENT OF POLLUTION.
For primary bibliographic entry see Field 06E.
W69-07056

AN ECOLOGICAL STUDY OF THE ALGAE OF THE RIVER MOOSI, HYDERABAD (INDIA) WITH SPECIAL REFERENCE TO WATER POLLUTION - 1. PHYSICO-CHEMICAL COMPLEXES,
Osmania Univ., Hyderabad, (India). Dept. of Botany.
V. Venkateswarlu.
Hydrobiologia, Vol 33, No 1, pp 117-143, Mar 1969. 26 p, 18 fig, 2 tab, 55 ref.

Descriptors: *Ecology, *Algae, *Rivers, *Water pollution, *Water pollution sources, Irrigation, Aquatic algae, Water analysis, Carbonates, Nitrates, Chlorides, Ammonium compounds, Oxygen, Silicates, Organic matter, Air temperature, Aerobic bacteria, Water temperature, Iron.
Identifiers: *India, Moosi River ecological study.

This investigation is concerned with the ecology of the River Moosi, Hyderabad (India) using the data extended over a period of two years with the collection of monthly samples. It deals mainly with the physico-chemical complexes present in the unpolluted and polluted waters of the river. The interrelationships and fluctuations existing between the following factors have been investigated: (1) chloride and water current; (2) nitrate, dissolved oxygen, and free ammonia; (3) nitrate and albuminoid ammonia; (4) free ammonia and albuminoid ammonia; (5) dissolved oxygen, oxidizable organic

matter, and water temperature; and (6) total iron and pH. (Gabriel-USGS)
W69-07096

INDUSTRIAL WASTE CONFERENCE,
Purdue Univ., Lafayette, Ind.
For primary bibliographic entry see Field 05D.
W69-07110

TRANSPORT OF CHROMIUM-51 IN AN ORGANICALLY POLLUTED ENVIRONMENT,
Tulane Univ., New Orleans, La. Dept. of Civil Engineering; and Texas Univ., Austin. Dept. of Civil Engineering.
Larry W. Canter, and Earnest F. Gloyna.
See also W69-07110. Proc 23rd Ind Waste Conf, May 7-9, 1968, Purdue Univ, Part 1, pp 374-387, 1969. 14 p, 9 fig, 3 tab, 11 ref. AT (11-1)-490.

Descriptors: *Path of pollutants, *Radioisotopes, *Chromium, Oxidation, Reduction, Organic matter, Water pollution, Oxidation-reduction potential, Water chemistry.
Identifiers: Chromium radioisotopes.

Laboratory flume studies of the transport of Cr-51 in streams with organic pollution showed that Cr in non-polluted river tends to exist in the hexavalent state regardless of its initial oxidation state. These findings support the observed predominance of Cr in the hexavalent oxidation state throughout the 240-mile length of the Columbia River below the Hanford reactors. Cr in organically-polluted river systems tends to exist in the trivalent state regardless of its initial oxidation state.
W69-07115

STUDIES ON IN-STREAM AERATION,
Tufts Univ., Medford, Mass.; and National Council of Paper Industries for Air and Stream Improvement, Inc.
For primary bibliographic entry see Field 05G.
W69-07119

FOAM SEPARATION BEHAVIOR OF AQUEOUS SUSPENSIONS OF CLAYS AND/OR IRON,
Marquette Univ., Milwaukee, Wis. Dept. of Civil Engineering; and Kentucky Univ., Lexington. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 05D.
W69-07125

LEACHING OF FERTILIZER IONS IN SOIL COLUMNS,
Western Australia Univ., Nedlands. Dept. of Soil Science and Plant Nutrition.
L. A. G. Aylmore, and Mesbahul Karim.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 143-153, 1968. 11 p, 6 fig, 17 ref.

Descriptors: *Soil water movement, *Leaching, *Fertilizers, *Ion transport, *Ion exchange, Diffusion, Dispersion, Solutes, Nutrients, Chlorides, Clays, Sulfates, Lysimeters, Phosphates.
Identifiers: Fertilizer leaching.

The movement of non-reactive and of reactive ions through columns containing artificial soils has been studied and the results compared with the distributions predicted by the chromatographic theories of Day, Lapidus and Amundson, Glueckauf, and Hiester and Vermeulen for the particular conditions of the experiments. Evidence has been obtained that the spreading of a solution-solvent boundary through longitudinal molecular diffusion is only of significance at flow rates of the order of 1 cm/hr or less. The holdback of non-adsorbed ions by diffusion into intra-aggregate pores at slow flow velocities has been illustrated. Comparatively good agreement between experimental and theoretical distributions was obtained under these controlled conditions for both non-reactive and reactive species. The results, however, illustrate the dependence of the progressive adsortion-desorption process by which the movement of a particular ionic species occurs on the presence of other ions, pH value and the complicities of soil constitution. These factors make a generalized theoretical approach to the movement of ions in solution through soils extremely difficult.
W69-07137

TRANSPORT OF ATRAZINE IN A LATOSOLIC SOIL IN RELATION TO ADSORPTION, DEGRADATION, AND SOIL WATER VARIABLES,
Hawaii Univ., Honolulu. Dept. of Agronomy and Soil Science.
R. E. Green, V. K. Yamane, and S. R. Obien.
Trans of 9th Int Congr of Soil Sci, Adelaide, Australia, Vol 1 of 4 vol, pp 195-204, 1968. 10 p, 3 fig, 7 ref.

Descriptors: *Pesticide kinetics, *Diffusion, *Path of pollutants, *Soil water movement, Adsorption, Hydrolysis, Biodegradation, Leaching, Chromatography, Dispersion, Permeameters, Hydraulic models, Mathematical models.
Identifiers: Pesticide transport, Latosols, Atrazine.

Atrazine transport in a latosolic soil was measured in the laboratory under saturated and unsaturated conditions. Effluent peaks for unsaturated columns were higher and arrived somewhat later than under saturated conditions. Atrazine elution from saturated columns was found to be nearly the same at flow velocities of 0.6, 3.5, and 7.0 cm/hour. A simple chromatographic model assuming a constant distribution coefficient, instantaneous and reversible adsorption, and laminar fluid flow was used to examine the extent to which adsorption alone would explain the transport of adsorbed molecules. The experimental elution curve arrived earlier and had much greater spread than predicted by the model. Important factors which were not accounted for by the model are variation in microscopic flow velocities and non-linearity of the adsorption isotherm. Chemical hydrolysis of atrazine and the higher adsorption of hydroxy-atrazine at some concentrations suggest that degradation is an important factor affecting atrazine mobility in the field. In conclusion, atrazine transport was closely related to the cumulative infiltration with little sensitivity to flow rate or prevailing water content. A chromatographic approach to the study of pesticide transport appears promising, but consideration must be given to both adsorption and dispersion factors.
W69-07139

5C. Effects of Pollution

THE REMOVAL OF DISSOLVED PHOSPHATE FROM LAKE WATERS BY BOTTOM DEPOSITS,
For primary bibliographic entry see Field 02H.
W69-06859

KINETICS OF CONTINUOUS CULTIVATION,
Takeda Chemical Industries Ltd., Osaka (Japan). Microbiological Research Labs.
Takehiko Kono, and Tsunetomo Asai.
Biotechnology and Bioengineering, Vol XI, Issue 1, pp 19-36, 1969. 10 fig, 4 tab, 5 ref.

Descriptors: *Kinetics, *Equations, Bioassay, Growth rates, Microorganisms, Mathematical studies, Theoretical analysis.
Identifiers: *Kinetic theory, *Continuous cultivation, Microbial growth, Population dynamics, Chemostats, Critical concentration, Coefficient of consumptive activity, Mutant populations.

The kinetics of continuous cultivation are developed by applying the theory of microbial cell growth presented previously by the authors. The theory is based on the concepts of critical cell concentration and a coefficient of consumptive activity. The kinetics of both single-stage and multistage reactors are developed and equations describing changes in cell concentration during the different phases of growth are given. Productivity of cell mass is defined and it is shown that productivity decreases as the number of stages of multistage reactors increases. Population characteristics of contaminants and mutants in continuous cultivation are considered by assuming that growth rate is proportional to that of the original cells. (Uttormark-Wis)
W69-06863

PROVISIONAL ALGAL ASSAY PROCEDURE,
Joint Industry-Government Task Force on Eutrophication, New York.
For primary bibliographic entry see Field 05A.
W69-06864

ALGAL CULTURE: FROM LABORATORY TO PILOT PLANT.

Carnegie Institution of Washington Publication 600, 357 pp, Washington, DC, March 1961. 103 fig, 59 tab, 297 ref.

Descriptors: *Algae, *Research and development, Bibliographies, Chlorella, Chlorophyta, Diatoms, Light, Lipids, Nutrient requirements, Organic matter, Photosynthesis, Temperature, Tropical regions.
Identifiers: *Algal culture, *Laboratory studies, *Mass culture, *Pilot-plant studies, Algal growth, Algal nutrition, Algal physiology, American Research and Development Corp (Mass), Arthur D Little Inc (Mass), Carnegie Dept of Plant Biology, Carnegie Institution of Washington, Chemical composition (England), Food sources, Greenhouse studies, Growth kinetics, Industrial raw materials (Israel), Light-energy conversion, Mineral nutrition, Research Corporation of NY, Stanford Research Institute (Calif), Sterols.

Research sponsored by the Institution is summarized, both in-house and contractual, on mass culture of algae in its basic aspects and in the developmental and engineering phases of harvesting and utilization as food. The scope is indicated by the subject-matter of chapters by various authors: Current status of large-scale culture of algae; need for new food-sources; biology of algae summarized; algal growth characteristics as applied to mass culture; efficiency of light-energy conversion in Chlorella; photosynthesis by Chlorella in flashing light; effect of diurnally intermittent light on Chlorella; inorganic nutrition of algae; laboratory experiments on Chlorella culture at Institution's laboratory; production of organic matter by chlorophytes and diatoms; non-sterile greenhouse culture; algal accumulation of lipids; British experiments; tropical cultivation of algal complexes; Israeli experiments; Chlorella growth kinetics; pre-pilot-plant and pilot-plant studies in mass culture; chemical composition of algae; nutritional values; algae as industrial raw materials; sterol content of algae. A selected general bibliography and list of literature cited is included. (Eichhorn-Wis)
W69-06865

CONTINUOUS CULTURE OF TORULOPSIS UTILIS WITH OXYGEN THE LIMITING NUTRIENT,
Wisconsin Univ., Madison. Dept. of Biochemistry.
Don Kuhner Button.
PhD Thesis, Wisconsin Univ, 1964. 57 p, 12 fig, 7 tab, 21 ref, 3 append.

Descriptors: *Yeasts, *Oxygen, Microbiology, Growth rates, Model studies, Kinetics, Water pollution effects, Eutrophication.
Identifiers: *Continuous culture, *Torulopsis utilis, *Limiting nutrients, Chemostats, Michaelis-Menton equation, Saturation constants, Growth kinetics, Microbial nutrition.

The yeast, Torulopsis utilis, was grown in continuous culture to determine the effect of low oxygen

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on growth rate. The Michaelis-Menton equation which relates growth rate to limiting nutrient concentration was used as a basis for analysis. The maximum growth rate was found to be 0.506/hours, and the saturation constant (oxygen concentration which produces growth at one-half the maximum rate) was determined to be 0.000014 Molar. The assumptions on which the theory of continuous culture is based were examined and for the conditions of this study it was concluded that: (1) the Michaelis-Menton equation provides a reasonable description of growth rate as a function of oxygen concentration; (2) steady-state did exist in the reactor and could be approached from both directions; (3) nearly all cells produced were viable thus growth rate was determined solely by the hydraulic residence time of the reactor; and (4) mixing in the reactor was sufficiently complete to allow steady-state conditions to become established. (Uttormark-Wis)
W69-06866

TROSCLAIR V SUPERIOR OIL CO (DAMAGES TO OYSTERS FROM OIL CONTAMINATION).
For primary bibliographic entry see Field 06E.
W69-06908

MICROORGANIC MATTER IN WATER,
Carnegic-Mellon Univ., Pittsburgh, Pa.
For primary bibliographic entry see Field 05A.
W69-06968

UPTAKE AND ASSIMILATION OF NITROGEN IN MICROECOLOGICAL SYSTEMS,
Geological Survey, Menlo Park, Calif.
G. G. Ehrlich, and K. V. Slack.
ASTM STP No. 448, Symp on Microorganic Matter in Water, Amer Soc Testing Mater 71st Annu Meeting, June 23-28, 1968, San Francisco, pp 11-23, Feb 1969. 13 p, 5 fig, 2 tab, 29 ref.

Descriptors: *Nitrogen compounds, *Nutrients, *Algae, *Microorganisms, Biodegradation, Nitrification, Denitrification, Organic compounds, Ammonia, Nitrites, Nitrates, Yeasts, Bacteria, Aquatic bacteria, Water pollution effects.
Identifiers: Nitrogen assimilation.

A study of biological nitrogen removal utilized 2 recirculating laboratory streams. The sole nitrogen source in 1 stream was calcium nitrate and in the other was yeast extract. Nitrite and nitrate increased slightly. Bacteria and combined nitrogen decreased rapidly after the initial rise. In the stream with the inorganic nitrogen medium, about half of the nitrate disappeared in 2 weeks, and nitrate was undetectable after the 3rd week. Bacterial counts were relatively low and constant. Periphyton increased in both streams as nutrients decreased, reaching quasi-steady states after about 4 weeks. The rate of biomass increase was greater in the inorganic medium. Nitrate was directly assimilated by algae. Organic nitrogen was converted to ammonia by proteolytic bacteria. Ammonia from organic compounds was partly assimilated by algae and partly nitrified by bacteria. Nitrate of bacterial origin was assimilated by algae. Nitrification apparently was not of major importance in converting organic nitrogen to algal biomass. Laboratory streams simulate natural streams in diurnal cycles of pH and dissolved oxygen, in periphyton growth rate and biomass, and in assimilation of nutrients. Use of model systems to study natural processes under controlled conditions appears justified. (Knapp-USGS)
W69-06970

A SPECIAL CASE, THERMAL DIGITAL SIMULATION OF WASTE HEAT DISCHARGES,
Battelle Memorial Inst., Richland, Wash.; and Computer Sciences Corp., Richland, Wash.
R. T. Jaske, and J. L. Spurgeon.
Water Res, Vol 2, No 11, pp 777-802, Nov 1968. 26 p, 16 fig, 10 ref. AT (45-1) 1830 USAEC.

Descriptors: *Thermal pollution, *Path of pollutants, *Computer models, Mathematical models, Systems analysis, Digital computers, Computer programs, Heat budget, Heated water, Thermal powerplants, Simulations analysis.
Identifiers: Digital simulation.

A thermal budget method is used in a digital computer simulation of the effects of thermal discharges combined with both conservative and non-conservative effluents. Digital computer flow charts are presented and the computations are discussed. (Knapp-USGS)
W69-06979

LEGAL CONTROL OF THERMAL POLLUTION,
For primary bibliographic entry see Field 06E.
W69-07054

EUTROPHICATION – CAUSES AND EFFECTS,
Michigan Univ., Ann Arbor. Dept. of Sanitary and Water Resources Engineering.
J. A. Borchardt.
J Amer Water Works Ass, Vol 61, No 6, pp 272-275, June 1969. 4 p, 2 fig, 1 tab, 1 photo, 4 ref.

Descriptors: *Eutrophication, *Water pollution sources, *Lakes, Nutrients, Fertilizers, Phosphates, Nitrates, Algae, Great Lakes.
Identifiers: Eutrophication prevention, Ecologic imbalances.

The causes and effects of accelerated eutrophication of lakes and streams are outlined. The important natural factors involved are geology, lake basin geometry and size, type and size of watershed, and latitude. The most important single variable is man's treatment of the lake. Accelerated eutrophication is a result of accelerated addition of phosphorus and nitrogen nutrients, nearly always caused by some form of human activity. Fertilizers, municipal wastes, industrial wastes, and recreational wastes are the most common nutrient sources. The most visible and obnoxious result of eutrophication is algae growth. Correction of eutrophic conditions is almost impossible. Prevention is necessary to avoid the problem in the future. (Knapp-USGS)
W69-07084

EFFECTS OF DAM REAERATION ON WASTE ASSIMILATION CAPACITIES OF THE MOHAWK RIVER,
New York State Dept. of Health, Albany. Bureau of Water Quality Management.
For primary bibliographic entry see Field 05G.
W69-07118

5D. Waste Treatment Processes

DIRECT CYCLE WATER REUSE PROVIDES DRINKING WATER SUPPLY IN SOUTH AFRICA,
National Inst for Water Research, Pretoria (South Africa).
G. J. Stander, and J. W. Funke.
Water and Wastes Eng, Vol 6, No 5, pp 66-68, May 1969. 3 p, 2 fig, 3 tab.

Descriptors: *Water reuse, *Reclaimed water, *Potable water, *Water quality, Sewage treatment, Municipal wastes, Industrial wastes, Municipal water, Water supply.
Identifiers: *South Africa.

In South Africa direct reuse of water for municipal supply is necessary because of limited water availability. The reclamation system of Windhoek consists of conventional sewage treatment, a maturation pond system, algae removal processing, and activated carbon filtration. Chemical analyses of reclaimed water, effluent quality, and bacterial removal data are tabulated. (Knapp-USGS)
W69-06942

CENTRAL WASTE HANDLING AT BAYPORT,
Friendswood Development Co., Houston, Tex.
George B. Meriwether.
Ind Water Eng, Vol 6, No 5, pp 35-37, May 1969. 3 p, 1 fig, 1 photo.

Descriptors: *Waste water treatment, *Industrial wastes, *Texas, Activated sludge, Water pollution control, Waste water disposal, Effluents, Facilities.
Identifiers: Bayport industrial complex (Texas).

Central waste treatment is recommended for groups of industrial plants in industrial complexes. Central treatment is more economical than individual facilities and is better for meeting effluent-standard regulations. At the Bayport industrial complex, Texas, an activated sludge plant costing over $6 million serves a 9,000-acre heavy-industry park with 10 industrial plants. Ultimate planned capacity is 40 mgd. Effluent criteria, input criteria, and non-acceptable wastes are tabulated. (Knapp-USGS)
W69-06944

ADSORPTION IN MULTICOMPONENT SOLUTION BY ACTIVATED CARBON,
Rhode Island Univ., Kingston. Dept. of Civil Engineering; and Rutgers - The State Univ., New Brunswick, N. J.
Calvin P. C. Poon, and Maw-hao Sung.
Water Resources Bull, Vol 5, No 1, pp 39-46, Mar 1969. 8 p, 3 fig, 3 tab, 7 ref.

Descriptors: *Tertiary treatment, *Activated carbon, *Adsorption, Nutrients, Organic compounds, Detergents, Sewage treatment.
Identifiers: Avtivated carbon regeneration.

It was found that the total adsorptive capacity of activated carbon was enhanced by using a multicomponent solution with glucose, peptone and phenylphosphonic acid. The removal of glucose was increased in the presence of phenylphosphonic acid. A maximum use of the carbon adsorptive capacity is possible if the carbon is used for tertiary treatment followed by treating a stronger waste.
W69-07099

THE COST OF CLEAN WATER AND ITS ECONOMIC IMPACT.
Federal Water Pollution Control Administration, Washington, D. C.

Fed Water Pollut Contr Admin Rep on Clean Waters, Vol 1, Jan 1969. 220 p, 15 fig, 53 tab, 22 ref.

Descriptors: *Water pollution control, *Sewage treatment, *Water quality act, *Economic impact, Costs, Municipal wastes, Industrial wastes, Farm wastes, Acid mine water, Water quality, Water quality control, Legislation, Waste disposal, Tertiary treatment, Water management (Applied).
Identifiers: *FWPCA.

National requirements and costs of water pollution control are summarized and national clean water goals are outlined. Over 90% of the Nation's sewered population is also served by waste treatment plants, and 60% with secondary treatment. Prevalence of treatment is greatest west of the Mississippi. Most of the untreated discharge is in New England, New York, and Pennsylvania. Generally, industrial waste-handling improvement investment is at about the level recommended by FWPCA, but municipalities are spending half that amount. The problems and recommendations made for improvement of present treatment and addition of new facilities are discussed in detail. (Knapp-USGS)
W69-07109

INDUSTRIAL WASTE CONFERENCE,
Purdue Univ., Lafayette, Ind.
Don E. Bloodgood.
Proc of 23rd Ind Waste Conf, May 7-9, 1968, Purdue Univ, Part 1, 1969. 618 p.

Descriptors: *Industrial wastes, *Water reuse, *Waste treatment, Waste identification, Water pollution treatment, Reaeration, Waste disposal, Waste water disposal, Injection wells, Water chemistry, Dissolved oxygen.
Identifiers: Industrial Waste Conference.

The 23rd annual Industrial Waste Conference, Purdue University, 1968, discussed means of treating industrial waste, industrial reuse of municipal waste water, and water pollution treatment in streams. Recovery of materials from wastes and identification of waste materials were also discussed. (Knapp-USGS)
W69-07110

ION EXCHANGE TREATMENT OF ACID MINE DRAINAGE,
Bethlehem Steel Corp., Pa. Homer Research Labs.; and Bethlehem Steel Corp., Pa. Engineering Dept.
J. J. Sterner, and H. A. Conahan.
Proc of 23rd Ind Waste Conf, May 7-9, 1968, Purdue Univ, Part 1, pp 101-110, 1969. 10 p, 3 fig, 3 tab, 1 ref.

Descriptors: *Water pollution control, *Waste water treatment, *Acid mine water, *Ion exchange, Neutralization, Limes, Mine acids, Iron, Sulfates.
Identifiers: Acid mine water treatment, Acid mine drainage.

A pilot plant using ion exchange to reduce pH, sulfate, and iron concentrations in acid mine drainage demonstrates that 15% aqueous sodium chloride solution is feasible regenerant for an ion exchange treatment in a process to produce effluent complying with the discharge standards of the Pennsylvania Sanitary Water Board. The cations, including dissolved iron, are concentrated into a waste stream which is only 1.7% of the volume of the original contaminated stream. The slight residual acidity of the product water is eliminated by treatment with lime. Larger amounts of lime are required to neutralize the waste stream, and this should be done at about 180 F. The neutralized waste stream can be settled to a sludge containing 10.5% solids or can be dewatered by filtering at 180-190 F to a cake containing 25% solids. Costs were $0.166 for NaCl, $0.109 for Ca0, and $0.019 for heating per 1000 gals of acid mine water. The quantity of lime required for neutralizing both the waste stream and the residual acidity of the processes stream would be the same as the quantity required for straight lime neutralization of the raw water, approximately 10.9 lbs Ca0 per 1000 gals of acid mine water.
W69-07112

WATER REUSE AT THE CELULOSA Y DERIVADOS, S. A. PLANTS,
Celulosa y Derivados S.A., Monterrey (Mexico). Copropiedad Grupo Quimico.
Hector J. Gomez.
Proc of 23rd Ind Waste Conf, May 7-9, 1968, Purdue Univ, Part 1, pp 165-169. 5 p, 2 tab.

Descriptors: *Water reuse, *Sewage treatment, *Waste water treatment, Activated sludge, Filtration, Ion exchange, Industrial water, Water supply, Municipal wastes.
Identifiers: *Monterrey (Mexico), Celelosa y Derivados.

Reuse of municipal waste water for industrial production in Monterrey, Mexico is described. About 60% of the city's water is reused by over 30 industries. Celulosa y Derivados was the first to purify domestic wastes. Raw sewage is sent to the treatment plant in a 10 mi long 24 in line. The first treatment is by an activated sludge process with a 2.2 mgd capacity. The chlorinated effluent is used for irrigation, fire protection, cooling, and input for tertiary treatment. Water for industrial process uses is clarified, softened and filtered. High-purity water is demineralized by ion exchange. Chemical analyses of waters in various treatment stages are tabulated. The activated sludge treatment costs $.07 per 1,000 gal, lime-aluminate filtration adds a cost of $0.18, and ion exchange adds $0.40. (Knapp-USGS)
W69-07113

SPRAY IRRIGATION OF ORGANIC CHEMICAL WASTES,
Commercial Solvents Corp., Terre Haute, Ind.
Richard A. Woodley.
Proc of 23rd Ind Waste Conf, May 7-9, 1968, Purdue Univ, Part 1, pp 251-261, 1969. 11 p, 1 fig, 3 tab.

Descriptors: *Waste water disposal, *Irrigation, *Chemical wastes, Sprinkler irrigation, Infiltration, Groundwater, Water levels, Water quality, Biochemical oxygen demand, Suspended load.
Identifiers: Organic chemical wastes.

At the Terre Haute, Indiana plant of Commercial Solvents Corporation, a spray irrigation system has been successfully utilized since August 1965 for treatment of high strength, low volume waste from aerobic industrial fermentation processes. Wastes varying in BOD up to 64,700 mg/1, suspended solids up to 99,700 mg/1, and flows up to 160,000 gpd have been routinely sprayed on 100 one-acre plots without causing any environmental nuisances or any community problems whatsoever. The land application system has been managed so that total treatment of all applied wastes has been achieved. Land and system management has consisted of spray plot selection, application time control, elimination of surface runoff, and control of surface ponding. Continuous wintertime operation has been achieved by pre-planning for minus zero C operations and the installation of rapid draining spray headers and laterals. Equipment subject to 24 hr contaminant of liquid is protected by various types of electrical heaters.
W69-07114

FOAM SEPARATION BEHAVIOR OF AQUEOUS SUSPENSIONS OF CLAYS AND/OR IRON,
Marquette Univ., Milwaukee, Wis. Dept. of Civil Engineering; and Kentucky Univ., Lexington. Dept. of Chemical Engineering.
C. J. Crandall, and R. B. Grieves.
Water Res, Vol 2, No 12, pp 817-832, Dec 1968. 16 p, 6 fig, 4 tab, 17 ref.

Descriptors: *Clays, *Iron, *Iron compounds, *Flotation, *Foam separation, Foaming, Surfactants, Surface tension, Water pollution treatment, Water treatment, Water purification, Foam fractionation, Sewage treatment, Tertiary treatment.
Identifiers: Foam flotation, Clarification.

To establish the relative efficiencies of foam separation of kaolinites, illites, and montmorillonites and to produce a further understanding of phenomena occurring at clay-water-air interfaces, and extensive experimental investigation is conducted. The study includes the effect that each of 6 clays has on the foam separation of iron, both divalent and trivalent, and any influence that iron may provide to the flotation of the clays. The effects are established on clay flotation, on iron flotation, on surfactant flotation, and on foamability, of clay type, of pH, and of the presence and form (determined by pH) of iron. A cationic surfactant, ethylhexadecyldimethylammonium bromide, is employed as the foam separation agent over the pH range 2.5-11.5. In general, the montmorillonites exhibit exceptional behavior due to their large specific surface and high exchange capacity. Results are interpreted in terms of a basic model involving the interaction of clay particles, surfactant cations, and soluble and/or particulate iron.
W69-07125

THE BACTERIAL DEGRADATION OF SYNTHETIC ANIONIC DETERGENTS,
Upper Tame Main Drainage Authority, Birmingham (England). Biological Lab.
Roaslynd Cook.
Water Res, Vol 2, No 12, pp 849-876, Dec 1968. 28 p, 15 fig, 11 tab, 13 ref.

Descriptors: *Biodegradation, *Detergents, *Surfactants, *Alkylbenzene sulfonates, Linear alkylate sulfonates, Water pollution treatment, Sewage treatment, Tertiary treatment, Aerobic bacteria.
Identifiers: Household detergent degradation, Slope culture.

Biodegradability of synthetic anionic detergents was studied using the slope culture technique. Solutions of the detergents known as JNX, JNQ, sodium tetrapropylene benzene sulphonate, a 'difficult' alkyl benzene sulphonate and Dobane 055 were inoculated with bacteria from various sewage works effluents which had undergone prior acclimatization to a particular detergent on an agar slope; unacclimatized bacteria were also investigated. Further tests were carried out using a single, standard effluent and a microbial slime from an experimental recirculating filter together with a more stringent testing procedure. The results of all tests showed that the detergents had a low biodegradability value and they were inconsistent. Bacteria which degraded JNX were isolated from a sewage works effluent and from the microbial slime which developed on an an experimental recirculating filter matured on JNX. Inoculation of the bacteria into a detergent solution was found to be ineffective in assessing their detergent degrading ability. A recirculating filter was developed for this purpose and proved to be successful. The active bacteria were members of the genera Klevsiella, Achromobacter, Flavobacterium, and Micrococcus. Degradation occurred in the presence of inert materials such as gravel, asbestos, or dried activated sludge provided that the detergent solution was vigorously agitated. The presence of an additional nutrient such as peptone did not appear to interfere with the normal degradation of the detergent. Attempts were made to induce the bacteria E. coli and Serratia marcescens to degrade JNX in a recirculating filter; these attempts were unsuccessful.
W69-07126

5E. Ultimate Disposal of Wastes

UNDERGROUND WASTE DISPOSAL,
Bradley Oil Corp., Tulsa, Okla.
J. L. Wright.
Ind Water Eng, Vol 6, No 5, pp 24-27, May 1969. 4 p, 8 fig, 4 tab, 5 ref.

Descriptors: *Waste disposal, *Industrial wastes, *Injection wells, Aquifers, Water quality, Legal aspects, Porosity, Permeability, Costs, Economics.
Identifiers: Deep-well waste disposal.

Deep-well disposal of industrial wastes is recommended for areas where laws and geological formations are favorable. The geology of several areas with favorable geologic conditions is discussed and estimated costs of injection and surface disposal are tabulated. (Knapp-USGS)
W69-06943

DIFFUSER DESIGN FOR DISCHARGE TO A STRATIFIED WATER,
Danish Isotope Center, Copenhagen.
Poul Harremoes.
Water Res, Vol 2, No 11, pp 737-752, Nov 1968. 16 p, 12 fig, 20 ref.

Descriptors: *Sewage disposal, *Outlets, *Coasts, *Density stratification, Currents (Water), Diffusion, Water pollution control, Flow, Ocean currents.
Identifiers: *Denmark, *Sweden, Diffusers, Outfall design.

Results from several tracer experiments with submerged sewage fields in long-shore currents having pronounced stratification are used as a basis for the economical optimization of a discharge of domestic sewage through a diffuser. Existing theories on jet

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diffusion have been modified to fit the observed conditions, which have almost arbitrarily varying density distributions. A first approximation to dispersion in stratified flow is applied with data derived from tracer experiments. Bacterial decay is disregarded due to the very slow decay rates previously observed in The Sound, which is the strait between Denmark and Sweden. The computation of fet diffusion and stratified dispersion is computerized to meet the demand for a statistical prediction of pollution and for selecting the most economical design among the infinite number of possible outfall designs. Density effects on the sewage field are suggested to be of significance to design criteria for diffusers.
W69-06978

DEEP WELL INJECTION OF INDUSTRIAL WASTES,
Hydro-Development, Inc., Bakersfield, Calif.
John C. Manning.
See also W69-07110. Proc of 23rd Ind Waste Conf, May 7-9, 1968, Purdue Univ, Part 2, pp 655-666, 1969. 12 p, 7 fig.

Descriptors: *Injection wells, *Waste disposal, *Industrial wastes, Aquifers, Groundwater movement, Waste water disposal, Water quality, Waste water treatment, Water levels, Permeability, Porosity.
Identifiers: Waste water injection.

When water is injected into a confined subsurface formation, the pressure in the formation is increased, and the formation tends to dilate. There is ample space in the subsurface reservoir for injection of large quantities of fluid so long as an areally extensive injection formation is available. Almost any area underlain by sedimentary rocks could have potential disposal reservoirs. Igneous or metamorphic rocks might have favorably situated subsurface zones, but generally these will not be as favorable as will the sedimentary rocks. Any waste fluid that is free of particulate matter and that, after reasonable treatment, will not cause undesirable reactions with the solid matrix of the disposal formation or its original fluid should be suitable for injection disposal. However, injection disposal is expensive and is best suited for relatively small quantities of particularly noxious wastes. All types of water desalination schemes have the problem of concentrated brine disposal, and where there is no convenient ocean, an injection well might provide a safe and convenient disposal.
W69-07117

5F. Water Treatment and Quality Alteration

REGIONAL SANITARY SEWER DISTRICT LAW.
For primary bibliographic entry see Field 06E.
W69-06925

THE PROBLEM OF MAKING WASTE WATER SAFE AND ITS USE IN IRRIGATING LIGHT CHESTNUT SOILS IN THE POVOLZHYE AREA,
Volgograd Agricultural Inst. (USSR).
For primary bibliographic entry see Field 03C.
W69-07005

INDUSTRIAL WASTE CONFERENCE,
Purdue Univ., Lafayette, Ind.
For primary bibliographic entry see Field 05D.
W69-07110

5G. Water Quality Control

CULTURAL EUTROPHICATION IS REVERSIBLE,
Wisconsin Univ., Madison. Lab. of Limnology.
Arthur D. Hasler.
BioScience, Vol 19, No 5, pp 425-431, May 1969. 3 fig, 1 tab, 7 ref.

Descriptors: *Eutrophication, *Fertilization, *Limnology, *Phytoplankton, Fish, Great Lakes, Legislation, Nitrogen, Nuisance algae, Phosphorus, Washington, Wisconsin, California.
Identifiers: *Cultural eutrophication, Lake Monona (Wis), Lake Tahoe (Calif), Lake Washington (Wash), Zurichsee (Switzerland).

Various human activities contribute to excessive enrichment (cultural eutrophication) of waters. Among the symptoms of cultural eutrophication are nuisance blooms of algae, increased nutrient levels, depletion of hypolimnetic oxygen, increased turbidity, and changes in the species-compositions of phytoplankton, invertebrates, and fishes. A case history is presented (Zurichsee) documenting changes in limnological conditions, as well as additional relevant data from North American lakes. As methods of solving the problems of cultural eutrophication, author suggests that more extensive dissemination of information, involvement of all citizens and citizen groups in workshops and seminars, and enlightened legislation. The Wisconsin Resources Law (1965) is given as an example of legislation and the philosophy of zoning is discussed. Three examples are given (Lakes Monona, Tahoe, Washington) where success is curbing cultural eutrophication has been achieved. Methods of control and harvesting aquatic plants and fish are discussed; also chemical control and sewage utilization. Table gives estimates of nitrogen and phosphorus input to Wisconsin surface waters. See also W68-00680. (Voigtlander-Wis)
W69-06858

INTERSTATE SANITATION COMMISSION - TRI STATE COMPACT.
For primary bibliographic entry see Field 06E.
W69-06889

STREAM STANDARDS AND WATER SUPPLIES,
Howard D. Zeller.
J Amer Waterworks Ass'n, Vol 61, No 3, pp 131-132, Mar 1969. 2 p.

Descriptors: *Water quality act, *Pollution abatement, *Regulation, *Long-term planning, Water pollution control, Water pollution effects, Water pollution sources, Water resources development, Water purification, Water quality control, Federal government, State governments, Legal aspects, Legislation, Planning.
Identifiers: *Clean Water Restoration Act.

The role of the federal government in the field of water pollution abatement is stated in the Water Quality Act of 1965 and the Clean Water Restoration Act of 1966. These acts establish a framework for the development of water quality standards by the states in cooperation with the federal government. The development of stream standards (including minimum water quality criteria and stream classification) and of plans for abatement of existing pollution are the basic objectives of the program. Stream standards provide the elements for long-range planning in the broad field of water resource management. The development of water quality criteria through the subcommittees named under the acts (National Technical Advisory Committee, NTAC) is a significant new development in the water pollution control field. Federal publication of the NTAC report and acceptance of all the state water quality criteria therein contained are the first steps in the development of a strong national program designed to enhance the quality of the nation's water resources. (Carruthers-Fla)
W69-06899

WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 06E.
W69-06926

INTERSTATE SANITATION COMMISSION.
For primary bibliographic entry see Field 06E.
W69-06939

WORKSHOP ON WATER RESOURCE PROBLEMS AND RESEARCH NEEDS RELATED TO AGRICULTURE IN THE COASTAL PLAINS OF NORTH CAROLINA,
North Carolina Univ., Chapel Hill. Water Resources Research Inst.
For primary bibliographic entry see Field 03F.
W69-06945

MICROBES AND MICROORGANICS IN WATER - A REVIEW,
Koppers Co., Inc., Monroeville, Pa. Dept. of Research.
G. R. Tallon.
ASTM STP No 448, Symp on Microorganic Matter in Water, Amer Soc Testing Mater 71st Annu Metting, June 23-28, 1968, San Francisco, pp 3-10, Feb 1969. 8 p, 17 ref.

Descriptors: *Biodegradation, *Organic matter, *Organic compounds, Industrial wastes, Water reuse, Biochemistry, Anaerobic bacteria, Aquatic microbiology, Sewage treatment, Water pollution treatment.
Identifiers: Non-degradable organic wastes.

Biological degradation in a stream is a highly complex, 'assembly-line' process. Most water-borne organics are consumed by microbes, but some substances may persist for long periods. Sources of refractory compounds may be industrial wastes, sewage plant discharges, land drainage, and even metabolic residues from microbial degradation of pollutants. Separation and identification of trace organics is an extremely difficult process requiring the most refined and sophisticated analytical methods. Increasing reuse of surface waters will require more surveillance and new approaches in water management. (For main entry see W69-06968.)
W69-06969

ANALYSIS FOR ORGANIC PESTICIDES IN AQUATIC ENVIRONMENTS,
Rutgers - The State Univ., New Brunswick, N. J. Dept. of Environmental Sciences; Rutgers - The State Univ., New Brunswick, N. J. Bureau of Conservation; and Drexel Inst. of Tech., Philadelphia, Pa.
For primary bibliographic entry see Field 05A.
W69-06971

GROUND-WATER POLLUTION FROM NATURAL GAS AND OIL PRODUCTION IN NEW YORK,
Geological Survey, Albany, N. Y.
For primary bibliographic entry see Field 05B.
W69-06975

OPTIMAL RELEASE SEQUENCES FOR WATER QUALITY CONTROL IN MULTIPLE-RESERVOIR SYSTEMS,
Michigan Univ., Ann Arbor.
Norbert Antone Jaworski.
Fed Water Pollut Contr Admin, Chesapeake Bay-Susquehanna River Basin Proj Tech Pap No 13, 1968. 231 p, 34 fig, 20 tab, 90 ref, 5 append. PhD dissertation - Michigan Univ.

Descriptors: *Water quality control, *Flow augmentation, *Reservoir operation, *Mathematical models, Computer models, Digital computers, Computer programs, Optimization, Dynamic programming, Operations research, Systems analysis, Simulation analysis, Synthetic hydrology.
Identifiers: *Potomac River Basin.

A method for determining optimal flow release sequences from multiple reservoir systems for water quality control was developed and field tested. The problem was organized as a converging

branch multistage dynamic programming decision system with 5 options for determining optimal release sequences at a decision point. These are: (1) minimum DO deficit for given BOD; (2) minimum DO deficit; (3) least cost of storage for given BOD; (4) least cost of storage; and (5) minimum BOD. A mathematical model of a river system including tributaries and impoundments was developed to simulate the river basin in the decision process. The Potomac River basin was used as a basis for the model and for field checks. Digital computer flow charts and program listings are included for the stream model and the release model. Data needs and costs are discussed and recommendations are made for data collection and analysis schemes for use in attaining optimal control of water quality in multiple reservoir systems. (Knapp-USGS)
W69-06982

GULF REFINING CO V DAVIS (SEEPAGE FROM A SALT WATER PIT).
For primary bibliographic entry see Field 06E.
W69-07016

MAGNOLIA PETROLEUM CO V WILLIAMS PROOF OF WATER WELL CONTAMINATION FROM SALT WATER DISPOSAL PIT).
For primary bibliographic entry see Field 06E.
W69-07017

CARVER V TANNER (DISCHARGE OF SALT WATER INTO STREAM).
For primary bibliographic entry see Field 06E.
W69-07019

PURDY V CITY OF NEWBURGH (REGULATION OF RIPARIAN RIGHTS WITH RESPECT TO WATER SUPPLY).
For primary bibliographic entry see Field 06E.
W69-07028

L A DARLING CO V WATER RESOURCES COMM'N (ADMINISTRATIVE REGULATION OF POLLUTION).
For primary bibliographic entry see Field 06E.
W69-07029

DELAWARE RIVER ABOVE AND BELOW TRENTON FALLS WITHIN JURISDICTION OF NEW JERSEY AND PENNSYLVANIA.
For primary bibliographic entry see Field 06E.
W69-07034

TAKING STURGEON; TAKING FOOD FISH WITH SCINE OR GILL NET; FINE AND FORFEITURE; USE OF CERTAIN NETS PROHIBITED; FINE AND FORFEITURE; PROHIBITED HOURS FOR FISHING; FINE AND FORFEITURE; USE OF PARALLEL NETS PROHIBITED.
For primary bibliographic entry see Field 06E.
W69-07036

STREAM OBSTRUCTION AND DUMPING.
For primary bibliographic entry see Field 06E.
W69-07052

LEGAL CONTROL OF THERMAL POLLUTION,
For primary bibliographic entry see Field 06E.
W69-07054

GRANT V UNITED STATES (SEWAGE DISPOSAL IN TIDAL WATERS).
For primary bibliographic entry see Field 06E.
W69-07057

COUNTY SEWER SURVEY COMMISSIONERS.
For primary bibliographic entry see Field 06E.
W69-07077

RESEARCH ON RECREATIONAL USE OF WATERSHEDS AND RESERVOIRS,
Public Health Service, Cincinnati, Ohio. Div. of Criteria and Standards.
For primary bibliographic entry see Field 06D.
W69-07085

COMPUTER-PRODUCED TABLES, MAPS, AND DIAGRAMS AS TOOLS IN THE INTERPRETATION OF BRINE DATA FROM SOUTHEASTERN KANSAS,
Geological Survey, Washington, D. C.
Jesse M. McNellis, Charles O. Morgan, and Brent H. Lowell.
Proc of Symp on Geochem of Subsurface Brines, Kansas Univ, Mar 25-26, 1968. Chem Geol, Vol 4, No 1-2, pp 303-324, Mar 1969. 22 p, 11 fig, 2 tab, 8 ref.

Descriptors: *Water chemistry, *Brines, *Data processing, *Digital computers, *Kansas, Computer programs, Data collections, Maps, Water qualtiy, Ions.
Identifiers: *Piper diagrams, Stiff diagrams, Tabulation, Automatic data plotting.

The applicability of computer-oriented techniques to assist in the interpretation of brine data is demonstrated by the use of 6 programs on data from 2 example areas. These programs include a data-tabling routine; routines for producing Stiff, Piper, and Ropes diagrams; programs for calculating ionic ratios; and programs for plotting maps of chemical data. The examples illustrate: (1) the range in water quality and contamination of potable water by brines in Stafford, Pratt, and Barber Counties, and (2) the change in water quality in the Arbuckle Group from southeast to south-central Kansas. (USGS)
W69-07102

CHEMICAL COMPOSITION OF SELECTED KANSAS BRINES AS AN AID TO INTERPRETING CHANGE IN WATER CHEMISTRY WITH DEPTH,
Geological Survey, Lawrence, Kans.; Kansas Univ., Lawrence; and Kansas State Geological Survey, Lawrence.
Robert J. Dingman, and Ernest E. Angino.
Proc of Symp on Geochem of Subsurface Brines, Kansas Univ, Mar 25-26, 1968. Chem Geol, Vol 4, No 1-2, pp 325-339, Mar 1969. 15 p, 10 fig, 1 tab, 17 ref.

Descriptors: *Water chemistry, *Brines, *Oil fields, *Kansas, Saline water systems, Saline water, Solutes, Aqueous solutions, Groundwater, Chemical reactions, Equilibrium, Ions, Ion exchange, Geochemistry, Aquifers, Connate water.
Identifiers: *Anomalous brines.

Chemical analyses of approximately 1,881 samples of water from selected Kansas brines define the variations of water chemistry with depth and aquifer age. The most concentrated brines are found in the Permian rocks which occupy the intermediate section of the geologic column of this area. Salinity decreases below the Permian until the Ordovician (Arbuckle) horizon is reached and then increases until the Precambrian basement rocks are reached. Chemically, the petroleum brines studied in this small area fit the generally accepted pattern of an increase in calcium, sodium and chloride content with increasing salinity. They do not fit the often-predicted trend of increases in the calcium to chloride ratio, calcium content and salinity with depth and geologic age. The calcium to chloride ratio tends to be asymptotic to about 0.2 with increasing chloride content. Sulfate tends to decrease with increasing calcium content. Bicarbonate content is relatively constant with depth. If many of the hypotheses concerning the chemistry of petroleum brines are valid, then the brines studied are anomalous. An alternative lies in accepting the thesis that exceptions to these hypotheses are rapidly becoming the rule and that indeed we still do not have a valid and general hypothesis to explain the origin and chemistry of petroleum brines. (USGS)
W69-07103

ION EXCHANGE TREATMENT OF ACID MINE DRAINAGE,
Bethlehem Steel Corp., Pa. Homer Research Labs.; and Bethlehem Steel Corp., Pa. Engineering Dept.
For primary bibliographic entry see Field 05D.
W69-07112

SPRAY IRRIGATION OF ORGANIC CHEMICAL WASTES,
Commercial Solvents Corp., Terre Haute, Ind.
For primary bibliographic entry see Field 05D.
W69-07114

INVESTIGATION OF THE EFFECTS OF CHANNEL GEOMETRY AND SURFACE VELOCITY ON THE REAERATION RATE COEFFICIENT,
New Mexico State Univ., University Park. Dept. of Sanitary Engineering; and Shell Oil Co., Bakersfield, Calif.
W. P. Isaacs, and J. A. Maag.
See also W69-07110. Proc of 23rd Ind Waste Conf, May 7-9, 1968, Purdue Univ, Part 2, pp 619-639, 1969. 21 p, 6 fig, 4 tab, 17 ref.

Descriptors: *Reaeration, *Channel morphology, Open-channel flow, Turbulence, Hydraulics, Shape, Width, Depth, Streamflow.
Identifiers: Reaeration coefficient.

A mathematical model of the relationship of channel geometry and reaeration coefficient is proposed based on a review of the literature and evaluation of published data. The proposed model compares well with Churchill's natural stream reaeration data. (Knapp-USGS)
W69-07116

EFFECTS OF DAM REAERATION ON WASTE ASSIMILATION CAPACITIES OF THE MOHAWK RIVER,
New York State Dept. of Health, Albany. Bureau of Water Quality Management.
Michael A. Mastropietro.
See also W69-07110. Proc of 23rd Ind Waste Conf, May 7-9, 1968, Purdue Univ, Part 2, pp 754-765, 1969. 12 p, 11 fig.

Descriptors: *Reaeration, *Dams, *New York, *Turbulence, *Overflow, Outlet works, Discharge (Water), Streamflow, New York State Barge Canal, Regression analysis.
Identifiers: *Mohawk River (NY).

Methods were developed to calculate stream reaeration where water falls over dams and weirs on the Mohawk River, N.Y. Dissolved oxygen and temperature data were collected above and below all the dams between Rome and the Hudson River. A linear regression analysis was made with saturation below the dam as the dependent variable and saturation above the dam as the independent variable. In the regression for the 15-ft dams with 25 observations, the correlation coefficient was 0.94531 with an F value of 201.60. The equation of best fit was y= 0.391 x+58.4. For 7-ft dams, 40 observations yielded a correlation coefficient of 0.98713, F= 1485.81, and the equation of best fit was y= 0.789 x+22.9. DO profiles of the river are shown graphically. (Knapp-USGS)
W69-07118

STUDIES ON IN-STREAM AERATION,
Tufts Univ., Medford, Mass.; and National Council of Paper Industries for Air and Stream Improvement, Inc.
James J. McKeown.

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See also W69-07110. Proc of 23rd Ind Waste Conf, May 7s9, 1968, Purdue Univ, Part 2, pp 1134-1146, 1969. 13 p, 12 fig, 1 tab, 7 ref.

Descriptors: *Reaeration, *Dams, *Turbulence, *Overflow, Outlet works, Discharge (Water), Streamflow, Waste treatment, Water pollution treatment, Water circulation, Spillways, Dissolved oxygen, Reaeration.
Identifiers: Stream reaeration.

Water falling over dams and subsequent downstream turbulence can aerate water with zero upstream DO, at rates as high as 1.0 lbs oxygen per HP-hr at falls up to 10 ft high. A fall of 17 to 20 ft into relatively shallow water or onto dam aprons will yield near-saturation conditions. Surface aerators in shallow ponds yield transfer efficiencies of about 1-1 1/2 lbs oxygen per HP-hr. Aerator efficiency is affected by recycle patterns of water in close proximity to the aerator containing high DO. Attempts to disturb the flow pattern developed by the surface aerators were partially successful. On/off operation of aerators and the introduction of a flow developer which directed water away from the turbine were investigated. A unidirectional flow pattern or an imbalance in aerator discharge direction incorporated in the design of such aerators for use in similar unrestricted systems warrants further investigation.
W69-07119

UTILITY AS A SURROGATE FOR VALUE IN WATER RESOURCES ANALYSIS,
Rutgers - The State Univ., New Brunswick, N. J.
For primary bibliographic entry see Field 06B.
W69-07158

ON THE NATURE AND SIGNIFICANCE OF SOCIAL COSTS,
Basel Univ. (Switzerland).
For primary bibliographic entry see Field 06C.
W69-07171

QUALITY OF THE ENVIRONMENT: AN ECONOMIC APPROACH TO SOME PROBLEMS IN USING LAND, WATER AND AIR,
Resources for the Future, Inc., Washington, D. C.
Orris C. Herfindahl, and Allen V. Kneese.
Baltimore, Maryland, The Johns Hopkins Press, 1965. 96 p.

Descriptors: *Water pollution, *Air pollution, *Pollution abatement, Oxygen sag, Organic waste, Water quality, Quality control, Pesticides, Transportation, Pesticide residues, Chemical wastes.
Identifiers: *Externalities, *Water quality deterioration costs, Degradable pollutants, Synthetic pollutants, Persistent pollutants, Primary pollutants.

The problem in the water resource area, and the natural resource area as a whole, is not one of exhaustion but rather a deterioration in the quality of the environment. The authors attempt to apply economic reasoning aimed at the balancing of desires in matters of resource planning compared to the costs of satisfying these desires in varying degrees. Five areas are selected where the actions of certain economic units are seriously affecting the use of the environment by others. These areas are: water pollution; air pollution; the purposeful introduction into the environment of chemical substances such as pesticides, insecticides, etc.; some developments in urban activities, architecture, and the use of urban space; the development of the rural countryside and wild areas. For each problem area the nature of the problem is explained along with the economics of the possible corrective measures suggested. The book concludes with a discussion of future research strategy. (Murphy-Rutgers)
W69-07180

DRY COMMENTS ON WATER,
J. K. Colman.
N Y Co Lawyers Ass'n Bar Bull, Vol 23, No 1, pp 9-14, 1965-1966. 6 p, 32 ref.

Descriptors: *New York, *Riparian rights, *Pollution abatement, *Water supply, Prior appropriation, Land tenure, Natural flow doctrine, Diversion, Relative rights, Cities, Legislation, Judicial decisions, Reasonable use, Beneficial purpose, Water pollution, Municipal water, Water law, Legal Aspects.
Identifiers: *Common law, *Civil law, *Interstate common law, N Y S Temporary Comm'n on Water.

Water shortage is the water problem of the future which is manifested today in New York City. Pollution is a prime contributor to the shortage. State legislation in pollution abatement has not been effective, but federal emphasis may bring needed change. The current shortage is related to the common law riparian doctrine itself. Of the four riparian rights concepts (common law, civil law, prior appropriation, interstate common law), the common law doctrine most obstructs beneficial use of water. The common law confines riparian rights to owners of land adjacent to streams. The rights cannot be extended regardless of need, since that would violate downstream rights in undiminished flow. Prior appropriation promotes beneficial use by allowing diversion of water for beneficial use. Although common law rights are subject to 'reasonable' use by other riparians, the difficulty in predicting what is reasonable discourages investment in beneficial use. An unreasonable appropriation can be very costly to the city. Acts and cases bearing on these problems are cited, and the New York State Temporary Commission on Water is seeking to reconcile present law with future needs. (Harrs-Fla)
W69-07199

FEDERAL-STATE RELATIONSHIPS IN THE ADOPTION OF WATER QUALITY STANDARDS UNDER THE FEDERAL POLLUTION CONTROL ACT,
H. E. Dunkelberger.
Nat Resources Lawyer, Vol 11, No 1, pp 47-61, Jan 1969. 15 p, 33 ref.

Descriptors: *United States, *Water quality act, *Water pollution, Water resources development, Pollution abatement, Water pollution control, Effluents, Discharge (Water), Streams, State governments, Wastes, Waste water disposal, Sewage effluents, Cities, Interstate rivers, Adjudication procedure, Administrative agencies, Regulation, Legal aspects, Legislation, Water quality control.

The Water Quality Act provides for adoption of federal standards of water quality only in the event that existing state standards are found inconsistent with the standards of the Act by the Secretary of the Interior. State standards adopted under the Act must protect the public welfare and serve the purposes of the Act. The Act provides that peculiar local conditions and circumstances be considered in formulating standards. This is a manifestation of Congressional rejection of a national effluent standard that would grant the Secretary arbitrary authority over state standards. Further evidence of restraints placed on the Secretary is that he may formulate state standards only after giving the state six months in which to enact suitable standards. If the state does not act, the Secretary must convene a public hearing in the affected area upon request of the governor. The hearing board may modify the standards promulgated by the Secretary. The author submits that the present practice of the Secretary in requiring a state to include specific provisions in its Water Quality Acts is an attempt to establish a national effluent standard and is beyond the authority of the Secretary. (Katz-Fla)
W69-07201

INTERSTATE COMM'N ON THE POTOMAC RIVER BASIN.
W Va Code Ann, secs 29-1c-1 thru 29-1c-5 (1966).

Descriptors: *West Virginia, *Pollution abatement, *Interstate compacts, *River basin comm'ns, Interstate rivers, Legislation, Pennsylvania, District of Columbia, Maryland, Virginia, Programs, Quality control, Sewage treatment, State governments, Federal government, State jurisdiction.
Identifiers: *Potomac River.

A commission of three members is created to act with commissioners appointed from Pennsylvania, Virginia, Maryland, and the District of Columbia together constituting the 'interstate commission on the Potomac River Basin.' A compact among the member states for the control of pollution is set out. The commission shall have power to: (a) collect data pertaining to pollution; (b) cooperate with other groups and agencies to promote uniform pollution laws; (c) disseminate public information in relation to stream pollution; (d) cooperate with other groups and agencies to formulate programs relating to stream pollution; (e) to comment upon plans of other groups and agencies; (f) recommend minimum standards for sewage treatment and establish water quality standards. Neither the governor nor any member of the commission shall consent to the construction of any dam within or without the state which shall flood lands in the state without the express consent of the legislature. (Kahle-Fla)
W69-07213

PERMITS AND POLLUTION CONTROL.

W Va Code Ann sec 20-5A-5 through 20-5A-8 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Permits, *Sewage disposal, *Water pollution control, Administrative agencies, Industrial wastes, Legislation, Municipal wastes, Sewage treatment, Waste disposal, Sanitary engineering, Pollution abatement, Water treatment, Operation and maintenance, Public health.

It is unlawful for any person to effect any substantial change in the character of sewage disposal from any industrial or commercial establishment without first obtaining a permit from the department of natural resources. All permit applications for activities relating to sewage should be submitted to the Division of Sanitary Engineering. The application should include a plan of proposed maintenance and operation. The Director of the Division of Sanitary Engineering shall determine the health aspects and then refuse or grant the permit. If approved, the permit and application should be forwarded to the division of water resources for final approval. After issuance of a permit, the chief, or his representatives, may periodically inspect the facilities to make sure there is no pollution. The chief can compel compliance with the terms and conditions in the permit by revoking or suspending the permit until such terms are complied with. (Stewart-Fla)
W69-07218

DEPARTMENT OF HEALTH.
Minn Stat Ann secs 144.01 to 144.03, 144.11 to 144.145, 144.35 to 144.37 (1946), as amended, (Supp 1968).

Descriptors: *Minnesota, *Supervisory control (Power), *Public health, *Water pollution, Fluoridation, Diseases, Environmental sanitation, Permits, Sewage disposal, Recreation, Safety, Sanitary engineering, Water purification, State governments, Administrative agencies, Regulation, Streams, Wells, Springs, Water pollution control, Legal aspects, Water supply, Legislation.

The Department of Health is continued under the supervision and control of the State Board of Health. The Board may make rules and regulations necessary to carry out its purposes. It shall enforce reasonable regulations for the preservation of the public health, and upon approval of the attorney general and after publication, such regulations have the force of law. The Board may control sewage disposal, water pollution, and the general

sanitation of hotels and resorts by licensing and other means. The Board shall promulgate rules and regulations relating to the fluoridation of public water supplies. The Board shall have charge of all watercourses used for the discharge of sewage or other matter and shall take all appropriate measures to insure that the public health is not endangered therefrom. The Board may order anyone polluting watercourses within the state to desist from such activity. Persons may appeal from any order issued by the Board. (Helwig-Fla)
W69-07228

PASSAIC VALLEY SEWERAGE DISTRICT.
N J Stat Ann secs 58:14-7, 58:14-8, 58:14-9 (1966), as amended, (Supp 1968).

Descriptors: *New Jersey, *Water pollution control, *Sewage, Administrative agencies, Legislation, Jurisdiction, Rivers, Tributaries, Sewers, Water law, Municipal wastes, Cities, Regulation, Water pollution sources, Sewage disposal, Pollution abatement, Odor, Gases, Local governments, Construction, Planning, Legal aspects.
Identifiers: Putrefaction.

The Passaic Valley Sewage commissioners are given the power to enforce provisions prohibiting the discharge of sewage or other polluting matter into the Passaic River between the Great Falls and Newark Bay by instituting the necessary civil actions in superior court. This court is vested with jurisdiction to enforce these provisions. The act also provides that no sewage, waste matter, or other substance which creates odors, gases, or fumes due to the putrefaction of organic matter may be dumped into the Passaic River or its tributaries between the points mentioned above. Whoever violates this provision, with the exception of a municipal corporation, shall be subjected to a penalty of one hundred dollars plus twenty five dollars for each day the condition remains unabated. The governing bodies of the municipalities may request the commissioners to submit plans for the construction of a trunk line or main intercepting sewer to comply with the mandates of this act. (Holt-Fla)
W69-07238

TEXAS CO V MONTGOMERY (POLLUTION CONTROL BY STATE AGENCIES).

73 F Supp 527-536 (E D La 1947).

Descriptors: *Louisiana, *Bayous, *Water pollution control, *Administrative agencies, Brine disposal, Well regulations, State governments, Streams, Lakes, Legislation, Judicial decisions, Legal aspects, Wildlife, Oysters, Federal jurisdiction, Water pollution sources, Water pollution treatment, Oil industry, Oil fields, Oil wastes, Coastal marshes, Gulf of Mexico.
Identifiers: Delegation doctrine.

The Texas Company brought a bill in equity to have a state statute creating the Louisiana Stream Control Commission declared void as violative of the Fourteenth Amendment to the Federal Constitution and as violative of certain articles of the Louisiana constitution. The Commission would control waste disposal of an 'unreasonable' nature into the lakes, streams, rivers and coastal waters of the state. Plaintiff contended that the statute was void on its face since the act failed to set forth an ascertainable standard of pollution to guide the Commission in the exercise of the delegated powers. The court recognized the need for a flexible definition of pollution due to varying water conditions and circumstances and refused to invalidate the statute for vagueness. The plaintiff's contention that the act was invalid in that it delegated unlimited authority to the Commission was denied. The court pointed out that only 'unreasonable pollution' could be regulated by the Commission. Finally, the court declared that the provisions in the act requiring a public hearing prior to the issuance of any Commission directive preserving the right to appellate review of Commission orders were sufficient to satisfy the due process requirements of the 14th Amendment to the Federal Constitution. The court declined to pass on possible violations of the state constitution, stating that such issue was not properly before the court for determination. (Katz-Fla)
W69-07253

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

THE DEVELOPMENT OF A MODEL TO EVALUATE HYDROLOGIC RISK IN A WATER RESOURCES SYSTEM,
Battelle Memorial Inst., Richland, Wash., and Texas A and M Univ., College Station.
William L. Bathke, and R. J. Freund.
Water Resources Bull, Vol 5, No 1, pp 53-61, Mar 1969. 9 p, 3 fig, 15 ref.

Descriptors: *Mathematical models, *Risks, *Systems analysis, *Synthetic hydrology, Optimization, Water resources development, Estimating, Streamflow forecasting, Water supply, Cost-benefit analysis, Operations research.
Identifiers: Water resource system risks.

A technique is described for analyzing a water resource system whose inflow is highly variable. The use of this technique requires not only that a mathematical model be developed of the physical, hydrological, and economic characteristics of the water resource system under study, but also that the economic benefits of the system, including full and partial water deliveries for irrigation development, be evaluated. Although developed independently of and simultaneously with the recently advanced concepts known in part as 'operational hydrology,' the technique described in this article includes some significant departures, such as the development of a complex revenue-loss function and water-shortage statistical characteristics for various reservoir sizes.
W69-07100

RULES FOR ORDERING UNCERTAIN PROSPECTS,
Case Western Reserve Univ., Cleveland, Ohio; and Kentucky Univ., Lexington.
Josef Hadar, and William R. Russell.
AER, Vol 59, No 1, pp 25-34, March 1969. 10 p, 8 ref.

Descriptors: *Average, Probability, Risks, Forecasting, Marginal utility.
Identifiers: *Orderability, *Uncertain prospects, *Utility function, *Variance, *Preference, Probability distribution, Quadratic utility function.

In many theoretical as well as practical situations one is frequently confronted with the necessity of making a prediction about a decision maker's preference between given pairs of uncertain alternatives without having any knowledge of the decision maker's utility function. The usual approach to this problem involves comparisons of means and variances of the probability distribution in question. However, rules of comparison involving only two moments are valid only for limited classes of utility functions, or for special distributions. Except for such special cases as the quadratic utility function, the specification of distributions in terms of their moments is not likely to yield strong results, essentially because information about the moments cannot be utilized efficiently for the purpose of ordering uncertain prospects when the utility function is unknown. In this paper the authors propose two rules which are more powerful than the 'moment method.' Under the stronger of these rules, distributions may be ordered according to preference, given any utility function, while under the weaker rule orderability obtains for any utility function which exhibits nonincreasing marginal utility everywhere. Water is often a product containing significant components of uncertainty in both its supply and demand functions, and this article extends the theoretical treatment of the role of uncertainty in utility analysis and has relevance to both water demand and supply analyses. (Loeb-Rutgers)
W69-07160

INTERREGIONAL FEEDBACKS IN INPUT-OUTPUT MODELS: SOME EXPERIMENTAL RESULTS,
Pennsylvania Univ., Philadelphia.
Ronald E. Miller.
Western Economic Journal, Vol 7, No 1, pp 41-50, March 1969. 10 p, 6 tab, 16 ref, 1 append.

Descriptors: *Input-output analysis, Leontief models, Regional analysis.
Identifiers: *Interregional feedback, Error, Interregional linkage, output, Percentage error.

Studies attempting to measure the impact on a particular region of exogenous changes in the demand for products of that region have frequently employed a regional input-output framework. In these models, linkage to the outside is usually expressed in an export column and an import row. More ambitions interregional models attempt to treat two or more regions with equal detail, specifying a complete input output matrix for each; in addition, flows in each direction between regions, by sector, are recorded in interregional matrices. The time, effort, and expense involved in collecting data frequently prohibit construction of an input-output coefficient matrix for a particular region. It is even more difficult to derive trade coefficient matrices between regions. Thus, a complete interregional framework has seldom been operational. Therefore, interregional feedback effects are usually lost in regional analyses. This paper presents the results of investigation into the question: how large are the interregional feedbacks likely to be in typical situations. Specifically, how much error results from ignoring interregional linkages and determining a region's gross outputs with only a single-region, intraregional model. This analysis would be of relevance to water research since significant research has recently been conducted in designing input-output models for water, especially in the Western states. (Loeb-Rutgers)
W69-07161

ON THE RELATIONSHIP AMONG DIFFERENT MEMBERS OF THE K-CLASS,
Washington Univ., Seattle.
Walter Y. Oi.
International Economic Review, Vol 10, No 1, pp 36-46, February 1969. 11 p, 13 ref.

Descriptors: Least squares method, Regression analysis, Dispersion.
Identifiers: *K-class method, *Ordinary least squares, *Two-stage least squares, Limited information, Reduced-form residuals, Specification errors, Collinearity.

The K-class can be viewed as a general estimation method which includes ordinary least squares, two-stage least squares, and limited information as particular members. This paper presents an alternative derivation of the K-class method in which least squares is applied to a structural equation after suitable transformations have been applied to the jointly dependent variables. Different members of the k-class (differing in their posited values of K) correspond to different transformations of measured reduced-form residuals. The relationships among parameter estimates of different K-class members are then revealed by the analysis of specification errors. These relationships take the form of mathematical identities. The conditions under which dispersion among different members of the k-class is a minimum are examined. It can be shown that the k-class estimators are weighted averages of the ordinary least squares and two-stage least squares estimators. Stochastic estima-

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tion techniques have increasingly been applied to water research problems. In particular, water demand and market studies often utilize regression and correlation methods. This article generalizes estimation methods for the water researcher and in the context of K-class estimation procedures. (Loeb-Rutgers)
W69-07163

EFFICIENT ESTIMATION OF DISTRIBUTED LAGS WITH AUTOCORRELATED ERRORS,
Pennsylvania Univ., Philadelphia.
Phoebus J. Dhrymes.
International Economic Review, Vol 10, No 1, pp 47-67, February 1969. 21 p, 1 tab, 11 ref, 1 append.

Descriptors: *Estimating, Markov processes.
Identifiers: *Estimation, *Distributed lag, *Autocorrelated errors, *Maximum likelihood estimators, *Likelihood function, Koyck's scheme, Lag structure, Consistency.

In this paper an expression for the estimators of the parameters of an infinite (Geometric) lag structure model which globally maximized the likelihood fuction is given. It is shown that such estimators are consistent, asymptotically unbiased and efficient. It was assumed that the error term of the model is a first order Markov process. Although this is somewhat restrictive, it is often found appropriate in econometric work. If this is indeed so, the author concludes that it would seem that the procedure herein described, which can be easily executed on a standard regression (Computer) program is to be preferred to others which approximate (Linearly) the likelihood function and employ a two step procedure. Empirical water demand and flow simulation studies may make use of distributed lag terms in the estimated equations of the model. This article has relevance to statistical water research by developing an efficient estimating technique for distributed lag structures. (Loeb-Rutgers)
W69-07164

LONG-RUN LINEARITY, LOCALLY GAUSSIAN PROCESS, H-SPECTRA AND INFINITE VARIANCES,
International Business Machine Corp., New York.
Benoit Mandelbrot.
International Economic Review, Vol 10, No 1, pp 82-111, February 1969. 30 p, 9 fig, 36 ref.

Descriptors: Frequency, Time series analysis, Statistical methods, Stochastic processes.
Identifiers: *Long-run linearity, *Locally Gaussian process, *H-spectra, *Infinite variance, *Econometrics, *High frequency effects, *Low frequency effects.

This paper describes the four concepts in the title of the article first separately and then through their interactions. The 'H-spectrum hypothesis' and the 'infinite variance hypothesis' are divergence hypotheses introduced to account for the main erratia aspects in the behavior of economic time series. Next to be studied are 'long-run linearity' and 'locally Gaussian processes,' which are new models added to econometrics. Most economic time series do not fulfill the independent Gaussian ideal of simplicity, even after possible gross nonstationarity has been eliminated by differencing. For analysis, discrepancies from independent Gaussian processes can be divided into two classes. The first includes 'high frequency effects,' to which the bulk of econometrics has so far been devoted. The second includes 'low frequency effects,' with which the present work is concerned. Two 'low frequency syndromes' of economics are described and are shown to be incompatible within the framework of the usual econometric models. A generalized model is constructed which allows for both syndromes. The investigation of time series problems by this article make it relevant to water simulation and flow studies and also to water demand analyses using time series data. (Loeb-Rutgers)
W69-07166

A FAMILY OF FUNCTIONAL ITERATIONS AND THE SOLUTION OF MAXIMUM LIKELIHOOD ESTIMATING EQUATIONS,
California Univ., Davis; and New South Wales Univ., Kensington (Australia).
Leon L. Wegge.
Econometrica, Vol 37, No 1, pp 122-130, January 1969. 9 p, 1 fig, 7 ref.

Descriptors: Regression analysis.
Identifiers: *Iteration, *Maximum likelihood, *Newton-Raphson method, *Gradient method, Convergence, Partial derivative, Likelihood function, Jacobian, FIML.

The two classical methods of finding a solution of a nonlinear system of equations are gradient methods and the Newton-Raphson method. The two methods are usually combined in such a way that the computational effort required is made as small as possible. In practice, the iterations are started with the gradient method until a point is reached that falls inside the region of convergence of the Newton-Raphson method. From there on, the iterations are continued with the Newton-Raphson method, not only because of its higher speed of convergence as compared to gradient methods, but also because in the end the partial derivatives have to be derived anyway in order to check for the second order conditions and/or to derive the covariance matrix of the estimates. The method proposed here provides an alternative to the Newton-Raphson method. Its main advantage lies in the fact that the functional form of the partial derivatives almost never has to be derived. Technically speaking, the iteration formula considered here is the same as the Newton-Raphson formula, except that the partial derivatives are replaced by suitably chosen approximations. This article could be helpful to the water researcher using such econometric methods, especially when investigating a highly nonlinear system of equations. (Loeb-Rutgers)
W69-07170

6B. Evaluation Process

URBAN ENVIRONMENTAL PROBLEMS: WHAT ARE WE LEARNING FROM ECONOMIC STUDIES OF WATER QUALITY,
Florida Univ., Gainesville. Water Resources Research Center.
Allen V. Kneese.
Engineering Progress, University of Florida, Vol XXI, No 6, Bulletin No 128, pp 5-18, June 1967. 13 p, 12 ref.

Descriptors: *Economics, *Water quality control, Control systems, Institutions, Theoretical analysis, Decision making, Costs, Damages.
Identifiers: *Research, Qualitative analysis.

There are four categories of important economic studies of water quality which are completed or in progress: (1) conceptual and methodological studies; (2) empirical evaluation studies; (3) studies of control systems; and (4) studies bearing upon desirable institutional change. Examples clarify the discussion of the first three categories. The concept and methodology of economic studies of water quality come from welfare economics. Empirical evaluation studies are concerned with: (1) the willingness of decision units to pay for the avoidance of damages; and (2) the cost to decision units that reduce external costs. Situations which require environmental control systems incorporating large-scale measures are described. Conclusions are: (1) Techniques for controlling water quality must result from analysis of values, contrary to the usual approach which is still focused on physical effects and objectives. Research in the economic values associated with water quality management has made significant progress, but has barely begun to illuminate many difficult problems; (2) Even carefully determined value-based rules governing decisions often cannot achieve optimal environmental quality management; more direct and explicit collective action on a regional scale is often indicated; (3) We are ill-equipped institutionally to implement those management systems and procedures which economic and engineering analysis suggests; appropriate research has hardly begun. (Gossen-Chicago)
W69-06841

URBAN ENVIRONMENTAL PROBLEMS: ROLE OF THE FEDERAL GOVERNMENT,
Florida Univ., Gainesville. Water Resources Research Center.
For primary bibliographic entry see Field 6E.
W69-06842

PROSPECTUS: WATERSHED PLANNING PROGRAM FOR BUFFALO AND MCDONALD CREEKS.
Harza Engineering Co., Chicago, Ill.

Harza Engineering Company, March 1968. 51 p, 2 fig, 2 map, 10 photo, 5 tab.

Descriptors: *Drainage programs, *Flood plain zoning, *Water quality control, *Aquifers, Water supply, Planning, Inter-agency cooperation, Costs, Scheduling, Financing, Illinois.
Identifiers: Buffalo Creek Watershed, McDonald Creek Watershed.

The report examines the Buffalo Creek and McDonald Creek Watersheds in terms of geography, geology and soils, hydrology, and urbanization. It reveals an urgent need for the preparation of a coordinated drainage plan for the entire area of both watersheds. Associated needs are: maintaining the open space necessary for flood plain management improving water quality, and raising aquifer water levels. The report proposes a planning study which: quantitatively defines the functional relationships in the watershed; simulates operation of natural stream channels and water control facilities; and tests the effects of different courses of action. All planning and implementation processes would require close cooperation among governmental units concerned. A Watershed Committee with representatives from principal governmental units of the watershed is recommended and charged with sponsoring the planning program. Its structure and its need for technical assistance are discussed. Steps of the program are discussed. An estimated study schedule is 18 months. Estimated cost is $69,000. Alternative means of financing are: by a Department of Housing and Urban Development grant; by the Metropolitan Sanitary District of Greater Chicago; by the State of Illinois; and by local governments. (Gossen-Chicago)
W69-06849

ATTITUDES OF LOCAL RESIDENTS TOWARD WATERSHED DEVELOPMENT,
Mississippi State Univ., State College. Social Science Research Center.
Satadal Dasgupta.
Mississippi State University, Social Science Research Center, Preliminary Report 18, May 1967. 30 p, 20 tab, 6 ref, 1 append.

Descriptors: *Attitudes, River basin development, Local governments, Projects, Community development.

The general objective of the study was to delineate factors which affect the attitudes of local landowners toward watershed development programs. Attitudes were analyzed at two levels: individual and community. Two similar communities, in which similar watershed projects were already underway, were selected for study. In analysis at the individual level, four status-variables were related to attitudes toward watershed development: organizational involvement; occupation; education; and level of living. An index (IPW), composed of the variables, had a stronger relation to attitudes than each variable singly. Two situational variables were related: degree of technical contact; and participation in planning. Knowledge of watershed development represented an intervening variable both in the relationship between the IPW and at-

titudes and in the relationship between situational variables and attitudes. Community A included a greater proportion than Community B of persons with high organizational involvement, non-farm occupations, high education, high level of living, high IPW scores, and experience of flood damage. The findings suggest that Communities A and B differed in degree of favorability because they had different proportions of landowners with knowledge of watershed development. (Gossen-Chicago)
W69-06850

THE PROGRAM FOR WATER MANAGEMENT.
North Central Texas Council of Governments.

North Central Texas Council of Governments, undated (mimeo). 15 p, 1 tab.

Descriptors: *Watershed management, *Programs, Water supply, Water quality control, Flood control, Water allocation (Policy), Sewerage, Drainage systems, Long-term planning, Short-term planning, Costs, Financing.
Identifiers: Inter-community water supply, Inter-community water quality control, Inter-community drainage systems, Inter-basin water supply, Water recycling.

Objectives of the program are: to develop a regional planning-and-development programming system which will insure the availability of an adequate water supply for the North Central Texas region; attainment and maintenance of desirable water quality standards; mitigation of flood problems; and development and maintenance of adequate water distribution, sewerage, and drainage systems. The program considers interbasin water supply relationships; water supply, quality control and drainage among communities; and intra-community distribution of water and collection and treatment of sewerage. The expected work program is described in sequence from February, 1968 to June, 1969. A table shows the development of work from the first steps, which are identification of sewerage system areas, water system areas, and drainage system areas, to the last steps, which include demonstrations of sewerage systems, of water recycling, and of drainage systems, a watershed demonstration, and a continuing planning program. Intermediate activities include evaluation of existing systems and of the plan's adequacy, designing a regional water quality monitoring system, establishing a flood damage rating system, and developing short-range, and interim plans. Outputs of the program will be applied in the areas of water management policy and of a comprehensive regional information system. Costs, funding, and supervision are discussed. (Gossen-Chicago)
W69-06851

SOCIOLOGICAL AND SOCIAL PSYCHOLOGICAL FACTORS RELATED TO METROPOLITAN WATER RESOURCES DEVELOPMENT,
Utah State Univ., Logan.
Wade H. Andrews.
Institute for Social Science Research on Natural Resources; Institute Series: Special Paper No 2, November 1968. 7 p.

Descriptors: *Water resources management, *Water resources development, Social values, Psychological aspects, Water demand.
Identifiers: *Social psychology, *Interdisciplinary research, Social organization, Social action, Diffusion of ideas, Sociological methodology.

The problem of interdisciplinary work is discussed with stress placed upon the problems of communication between the various fields due to differing jargons of expression; problems of different methodologies or approaches to problems; different levels of development regarding methodology; and, widespread specialization within individual fields. The remainder of the article deals with aspects of social psychology and sociology which are related to water problems. The aspects considered include values, social organization, social action, the process of diffusion of ideas and research methodology. Emphasis is placed on the very small amount of research being conducted on sociological aspects of water resources development. Six such research projects are briefly described. (Davis-Chicago)
W69-06853

TOWARD THE SOCIOLOGICAL ANALYSIS ON NATURAL RESOURCES AND SOCIETY,
Utah State Univ., Logan.
Wade H. Andrews.
Institute for Social Science Research on Natural Resources; Institute Series: Special Paper No 1, September 1968. 12 p, 34 ref.

Descriptors: *Natural resources, *Pollution abatement, *Water resources, Land resources, Wildlife, Motivation, Attitudes.
Identifiers: *Sociology, Social problems, Social structure, Resource use, Mineral resources.

Natural Resources provide a new direction for sociological research based on the social systems, patterns of behavior, motivation, values and attitudinal aspects associated with and structures around natural resources. The need to pursue these studies was based on the following assumptions regarding the importance of natural resources: (1) population growth is increasing the demand upon natural resources; (2) there is a finite limit to resources; (3) certain resources are irreplaceable; (4) a growing sense of aesthetics; (5) pollution must be controlled; (6) order in development is necessary for future well-being; and, (7) planning is the basis for this order. This sociological study of natural resources can be approached from four viewpoints: (1) the resource itself as a point of departure; (2) a stress on the uses of resource; (3) the identification of social problems related to resources; (4) the relationship of resources to social structure. These topics are then discussed in regard to a typology of resources. This typology includes: water resources; land resources; mineral resources; forestry and wilderness; wild life; and, the special problem of resource pollution. (Davis-Chicago)
W69-06854

THE RELATION OF WATER RESOURCES TO THE INDUSTRIAL AND RECREATIONAL POTENTIAL OF THE MISSISSIPPI GULF COAST,
Mississippi State Univ., State College. Water Resources Research Inst.
A. A. Armenakis, R. F. Pearson, and W. P. Neely.
Water Resources Research Institute, Mississippi State University, 1968. 186 pp, 6 fig, 8 map, 44 tab, 128 ref, 2 append.

Descriptors: *Water resources, *Mississippi, Water quality, Industries, Training, Industrial wastes, Transportation, Water resources development, Recreation facilities, Recreation demand, Human population, Average income, Education, Economic life, Utilities, Communication, Natural resources, Climatic data, Topography, Drainage, Geology, Hydrology, Groundwater, Surface waters, Legal aspects.
Identifiers: *Industrial potential, *Recreational potential, Jackson County (Miss), Harrison County (Miss), Hancock County (Miss), Industrial distribution, Industrial facilities.

After outlining the purpose, scope, and methodology of the study, the report surveys the characteristics of the study area, which includes Jackson, Harrison, and Hancock Counties in Mississippi. Characteristics discussed are: population breakdown, population trends, income per capita, race breakdown, education breakdown, present and planned housing, economic development, utilities, governmental structure, communications, location, natural resources, non-water transportation, climate, topography and drainage, and geology and hydrology. Chapter III discusses fresh water resources of each county, problems in quality of surface water and groundwater. Chemical analyses of surface and groundwaters, and legal restrictions concerning stream pollution. Chapter IV discusses industrial distribution, industrial facilities and industries of each county, vocational education, and the gulf coast fishing industry. Chapter V discusses present industrial water consumption, projected future demand, and industrial pollution. Chapter VI analyzes major water-using industries from a mail questionnaire and follow-ups. Chapter VII discusses salt water transportation. Chapter VIII studies proposed developments of water resources in each county. Chapter IX discusses recreational facilities of the Mississippi Gulf Coast. It covers the national demand for recreation, assets of the Mississippi coast, and several proposed and existing facilities. Chapter X studies the industrial and recreational potential of the Mississippi Gulf Coast. (Gossen-Chicago)
W69-06857

WORKSHOP ON WATER RESOURCE PROBLEMS AND RESEARCH NEEDS RELATED TO AGRICULTURE IN THE COASTAL PLAINS OF NORTH CAROLINA,
North Carolina Univ., Chapel Hill. Water Resources Research Inst.
For primary bibliographic entry see Field 03F.
W69-06945

ECONOMIC EVALUATION OF A WATER RESOURCES DEVELOPMENT PROJECT IN A DEVELOPING NATION,
California Univ., Berkeley. Hydraulic Engineering Lab.
Fereidoun Mobasheri.
Calif Univ Water Resources Center Contrib No 126, July 1968. 191 p, 14 fig, 30 tab, 79 ref, 2 append. OWRR Proj No A-003-CAL and B-041-CAL.

Descriptors: *Water resources development, *Economic justification, *Economics, Cost-benefit analysis, Social values, Social needs, Labor supply, Water supply, Engineering structures, Engineering estimates, Irrigation, Crops, Hydroelectric power, Aquifers, Planning.
Identifiers: *Developing nation, Economic evaluation.

This study presents a detailed economic evaluation of water resources in any developing nation on the basis of experience obtained in conducting water resources surveys and water control in the developed nations. The monograph discusses the following: some characteristics of developing nations and the aims of economic planning; approaches for economic evaluation of public investment projects; the concept of benefit-cost analysis and need for its modification; modification of benefit-cost analysis, synthesis of a new criterion; and optimum design of a multiple purpose water resources project. It is concluded that whenever investment in a water project is considered, questions such as what is the economic value, what is the optimal scale of development, and what is the economic rating of the project, among alternative projects, should be answered. A sensitivity analysis is summarized and considers the annual rate of GNP growth, balance of payments equilibrium, and underemployment of unskilled labor force. (Gabriel-USGS)
W69-06981

REGIONAL DEVELOPMENT AND THE RURAL POOR,
Kentucky Univ., Lexington.
Niles M. Hansen.
The Journal of Human Resources, Vol 4, No 2, pp 205-214, Spring 1969. 10 p, 1 tab, 15 ref.

Descriptors: *Industries, *Migration, *Unemployment, *Human resources, *Costs, government, Rural areas, Investment, Taxes, Area development, Wages, Priorities.

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Identifiers: *Poverty, *Social costs, *Federal programs, Opportunity costs, Subsidies, Tertiary sector, External economics.

The regional policy of the President's advisory Commission on Rural Poverty is based on the assumption that the social costs of bringing industry to relatively poor regions would be less than the social costs involved in the migration of workers and increased congestion and unemployment in industrial areas. This presents a problem for water resource development in previously unindustrialized areas. Federal programs to influence the quality of human resources in lagging rural areas benefit the people of these regions and the nation as a whole. Opportunity cost considerations favor federal subsidies for investment in education, health, and training in lagging regions, as well as for relocation subsidies and information programs to facilitate rational migration towards intermediate regions where growth is rapid but where congestion poses no immediate threat. Recently, some research has pointed out the potential income redistribution effects of water projects. The possible income effects on rural poverty areas generated by water developments makes this article relevant to the regional planner. (Murphy-Rutgers)
W69-07155

PERPLEXING PROBLEMS IN DECISION THEORY,
Massachusetts Inst. of Tech., Cambridge.
Billy E. Goetz.
The Engineering Economist Vol 14, No 3, pp 129-140, Spring 1969. pp 12, ref 8.

Descriptors: *Dynamic mathematical model, *Decision making, *Priorities, Discount rate, Overhead cost.
Identifiers: *Quantitative models, *Decision models, *Utility transforms, *Aggregation level, *Algorithmic solution, Periodic reports, Hypothesis, Total net cash flow.

An objective of this article was to present arguments important to potential research projects. In sequence, these points included determining the scope of the problems, and in what order they should be treated. Hypotheses should then be created and selected, hopefully to incorporate risk into decision making models and to determine aggregation levels for such items as cash flow, increments, overhead costs, and time horizon. A dynamic model of the system under study is suggested, with an integrated view resulting from a quantitative model that is subject to algorithmic solution. This method might help to systematize research and lessen intuition, and would therefore be helpful to the water researcher. (Murphy-Rutgers)
W69-07156

UTILITY AS A SURROGATE FOR VALUE IN WATER RESOURCES ANALYSIS,
Rutgers - The State Univ., New Brunswick, N. J.
William Whipple, Jr.
The Engineering Economist Vol 14, No 3, pp 159-167, Spring 1969. pp 9, ref 9.

Descriptors: *Water-resource development, *Water pollution control, *Systems analysis, *Decision making, Optimization, National income.
Identifiers: *Utility benefit approach, *Intangible aspects, *Utility analysis, *Net utility advantage, Net output, Water resources system, Minimization of cost.

This article proposes a utility benefit approach to water-resource development to maximize net output of goods and services in view of the constraints imposed by intangible aspects. The utility approach would permit a determination of the national effect of water-pollution control, and would facilitate systems analysis of water-resources systems to aid pollution control. Utility benefit analysis should be applied in this area, since its analytical advantages result is a series of alternatives evaluated in utility terms including the intangibles involved. Any evaluation of these intangibles should be opinion, since the matter is not subject to objective determination. A systems analysis of these intangibles presents difficulties, which can be avoided by confining the analytical process to minimizing the cost of achieving an objective decided upon based on the intangibles. This alternative does not evaluate national income and product in relation to the proposal, and thus the utility analysis has the greatest probability of increasing national welfare, when balanced against intangible effects. (Murphy-Rutgers)
W69-07158

ECONOMIC ASPECTS OF WATER RESOURCE POLICY,
Wisconsin Univ., Milwaukee.
Mason Gaffney.
The American Journal of Economics and Sociology, Vol 28, No 2, pp 131-144, April 1969. 14 p

Descriptors: *California, *Water policy, *Water resources, *Water development, *Irrigation districts, *Marginal costs, *Capital, *Aquifers, *Irrigation, *Water rights, *Riparian doctrine of water rights, Storage, Drainage, Motivation, Political aspects.
Identifiers: *Pooling, *Community action, *Diminishing returns, *Water systems, Compactness, River development, Spillover benefits, Rationing.

A description is given of what the author has learned from the experience of the Western States in economizing on water for the purpose of aiding eastern researchers. The need for community action in the area of water resources is pointed out with a discussion of the benefits of the irrigation districts originating in California. State action is also needed, primarily in the area of defining property rights in water. It is necessary for the federal government to define interstate water property questions and it should redirect its own priorities in the water resources area. With water becoming increasingly scarce and riparian doctrine of water rights is unsatisfactory and the reasons necessitating its abandonment are presented. Likewise, the reasons for the failure of the appropriative doctrine of water rights are discussed. There has been a failure to economize on rent-bearing waters which results in the wasting of local waters adding to the already highly expensive conveyance and distribution problems. The fact that water evinces diminishing returns suggests several corollaries which are discussed. The acute capital shortage and high interest rates should not stop the necessary water supply investments. (Murphy-Rutgers)
W69-07159

AGGREGATE PRODUCTION FUNCTIONS AND TYPES OF TECHNICAL PROGRESS: A STATISTICAL ANALYSIS,
Brown Univ., Providence, R. I.
Martin J. Beckmann, and Ryuzo Sato.
AER, Vol 59, No 1, pp 88-101, March 1969. 14 p, 6 tabs, 13 ref, 1 append.

Descriptors: Regression analysis, United States, labor, capital.
Identifiers: *Aggregate production function, *Technical progress, CES function, Neutrality, Cobb-Douglas production function, Neutral technical progress, Japan, Germany.

One of the difficulties encountered in estimating the rate and type of technological progress is that of accurate specification of the aggregate production function and the type of technical progress. In recent work the type of production function most commonly applied is the CES function. In this paper the authors examine the case where exogenous forms of technology are assumed. For theoretical and technical convenience, 'neutrality' in the sense of Hicks or Harrod is assumed. Complications arise due to the fact that problems of specification of the form of a production function and the form of technical progress are not independent. The paper discusses the close connection between the form of a production function in general and the type of exogenous technical progress, that would be consistent with a given form of a production function. It is also shown that various new types of 'neutral' technical progress can be meaningfully determined and that the standard definitions of Hicks and Harrod are reclassified in a more general framework. The paper examines some results by presenting statistical evidence on the forms of production functions and on the types of technical progress. A considerable economic literature exists on production function analysis on both theoretical and empirical levels. The analysis of water supply problems via a production function approach is a natural extension of this literature and as such this article treats the problems of introductory technical change into production analysis. (Loeb-Rutgers)
W69-07162

TECHNICAL PROGRESS AND INVESTMENT,
Osaka Univ., (Japan).
Susumu Koizumi.
International Economic Review, Vol 10, No 1, pp 68-81, February 1969. 14 p, 5 fig, 11 ref, 1 append.

Descriptors: *Investment, Capital, Costs, Linear programming, Marginal costs.
Identifiers: *Technical progress, *Acceleration model, *Capital-stock adjustment model, Capital accumulation, Substitutes, Investment decision, Capital-labor ratio.

Recent years have seen many studies, empirical as well as theoretical, on the investment function. Little has been said, however, about the effects of technical progress on investment decisions, whereas nobody would deny the importance of technical progress in the process of capital accumulation. The present paper aims at advancing a theory of investment under a situation in which the type of technical progress taking place is of a form which introduces a new technique to produce an already existing product or a new close substitute thereof. The author presents a theoretical model of investment which incorporates the effects of technical progress. The relation between technical progress and the economic life of capital goods are discussed. The implication of the investment model is clarified and an interpretation of the model as a version of the acceleration model is presented. This is of importance to researchers investigating investment decisions in the water area due to the important role played by technical progress in water resource development. (Loeb-Rutgers)
W69-07165

A NOTE ON DEMAND FOR PUBLIC GOODS,
Social Security Administration, Washington, D. C.
Ronald F. Hoffman.
The Canadian Journal of Economics, Vol 11, No 1, pp 125-120, February 1969. 6 p, 1 fig.

Descriptors: Probability, Competition, Marginal costs, Risks.
Identifiers: *Public goods, *Output consumption, *Externalities, Conflict, Preference, Exclusion principle.

The purpose of this note is to suggest a model of the world of competition, uncertainty, and externalities in output consumption, in which individuals maximize their own self-interest while revealing their preference for public goods. The model offers an explanation of the motive which leads individuals who maximize conflicting self-interest to reveal their preferences for public goods. The author's basic idea is that each individual behaves so as to maximize his expected utility from a proposed incremental public expenditure. The occurrence of the proposed increment is uncertain because it is contingent upon adequate finance; the community must provide payment. Each individual possesses a subjective probability distribution of occurrence; he presumes there is a positive relation between his bid and the associated probability that the offer of

the total community will be sufficient to finance the marginal cost of the increment. The individual reveals his true preference in the form of an offer to share in the cost of the increment. Water projects and their associated benefits often contain significant public-good components. The public good nature of water frequently leads to pricing and benefit measure problems for the developing authorities. This discussion of this article may have some applications in designing benefit and pricing schemes for water development projects. (Loeb-Rutgers)
W69-07167

CONDITIONAL PREDICTION AND UNBIASEDNESS IN STRUCTURAL EQUATIONS,
Massachusetts Inst. of Tech., Cambridge.
Gordon M. Kaufman.
Econometrica, Vol 37, No 1, pp 44-49, January 1969. 6 p, 6 ref.

Descriptors: Forecasting, Least squares method, Regression analysis.
Identifiers: *Conditional prediction, Unbiasedness, Structural equations, Conditional least squares.

Sewell has discussed a generalized version of a problem of conditional least squares estimation treated earlier by Waugh and Srinivasan. The purpose of this note is twofold: first, to give an alternative proof of Sewell's main result that leads to some ancillary facts about conditional least squares estimators; second, to present direct methods for evaluating the normalizing constant of the generalized multivariate t density and for computing the expectation of the random matrix (W) inverse when S is Wishart distributed. The expectation of (W) inverse is needed to compute the covariance matrix of the generalized multivariate t density. The constant mentioned above as well as the expectation of (W) inverse can be derived indirectly by considering a moment generating function. The extension of econometric methodology makes this article relevant to the water researcher concerned with econometric techniques. (Loeb-Rutgers)
W69-07169

ON THE NATURE AND SIGNIFICANCE OF SOCIAL COSTS,
Basel Univ. (Switzerland).
For primary bibliographic entry see Field 06C.
W69-07171

UNEMPLOYMENT, IDLE CAPACITY, AND THE EVALUATION OF PUBLIC EXPENDITURES,
Grinnell Coll., Iowa; and Resources for the Future, Inc., Washington, D. C.
R. H. Haveman, and J. Krutilla.
Baltimore, Maryland, Johns Hopkins Press, 1968. 159 p.

Descriptors: *Water resource development, *Cost-benefit analysis, Unemployment, Costs.
Identifiers: *Public investment criteria, Occupational labor demand, Opportunity costs, Shadow adjustment, Market costs, Primary inputs, Economic capacity, Input-output.

Public expenditure criteria, with assumed full employment, has been increasingly applied to the process of choosing among alternative public expenditures and the process of designing public works projects. If substantial unemployment exists market cost and price data become of little value and a problem of estimating appropriate benefit and cost adjustments for benefit-cost analysis arises. Recently, new sources of data have become available which enable the development of models which trace the final bill for expenditures to the factor sources which supply the primary inputs to public expenditures. These models are presented and implemented. Relationships are developed to estimate the percentage of labor required for the construction of public projects which will be drawn from the idle pool. Industrial output demands and estimates of capacity utilization by industry serve as the basis for developing estimates of the percentage of capital facilities used which were idle. This study, then, evaluates the opportunity cost of public expenditures in periods of less than full employment by analyzing one type-water resource development--among the whole range of public expenditures. (Murphy-Rutgers)
W69-07173

INDUSTRIAL FLOOD LOSSES: DAMAGE ESTIMATION IN THE LEHIGH VALLEY,
Chicago Univ., Ill.
R. W. Kates.
Chicago, Illinois, University of Chicago Press, 1968. 76 p.

Descriptors: *Water resource development, *Optimum development plans, *Delaware River, *Flood damage, River basin development, Industrial production flood proofing.
Identifiers: *Lehigh Valley, *Methodology, *Stage-demand functions, Synthetic estimates, Managerial behavior, Production loss, Factors of production.

This book is an extension of two previously developed lines of research in water-resource management. The first has to do with optimal design of river basin systems. Thus, in the first part the assumptions and procedures that underlie the estimates of damage, that serve as measures of flood control benefits are reviewed. This serves as a benchmark from which to assess the techniques of constructing synthetic damage estimates. Synthetic damage estimates, under alternative assumptions of managerial behavior, had been prepared for commercial and residential land uses for one town. This technique had been extended to other towns differing in physical characteristics of flooding. This line of research was further related to industrial properties in the heavily industrialized Lehigh Valley. Part two reports the result of this research, presented largely in the form of synthetic stage-demand functions for industrial properties under different assumptions of economic evaluation and human adjustment. (Murphy-Rutgers)
W69-07174

POLICY ISSUES AND PROBLEMS IN OUTDOOR RECREATION,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
John C. Frey, and Hays B. Gamble.
Journal of Farm Economics, Vol 49, No 5, pp 1307-1317, December 1967. 11 p, 2 fig, 10 ref.

Descriptors: *Recreation, *Welfare, Recreation demand, Recreation facilities, Pricing, Costs, Taxes, Profit, Supply, Demand, Benefits.
Identifiers: *Policy issues, *Market mechanism, Marginality, Marginal rate of substitution, User charge, Consume, Transportation costs, Consumer preferences.

The primary intent of this paper is to establish a rationale based on economic logic for maximizing efficiency and welfare in outdoor recreation. The authors attempt to show the necessity for a market mechanism in outdoor recreation if resource allocation, firm efficiency, and consumer welfare objectives are to be met. Knowledge of consumer preferences for outdoor recreation is necessary for efficient allocation of resources and may best be achieved through a market pricing system for recreational services. Consumer welfare may be further increased by reducing transportation costs and by locating new outdoor recreation facilities as close as possible to large population centers. In view of current social value judgments plus private capital limitations, there appears to be a strong need for continued public involvement in outdoor recreation. A pricing policy for multipurpose operations may be necessary for efficient allocation of factors in both the public and private outdoor recreation sectors. To accommodate the advantages of institutional control offered by public ownership, plus the desirability of the profit-maximizing objective which accompanies private development, a joint public-private partnership business venture is suggested as an alternative for future expansion of the outdoor recreation industry. The crucial role of water in most outdoor recreation makes this article relevant to the water resources area. (Loeb-Rutgers)
W69-07177

DISCUSSION: POLICY ISSUES AND PROBLEMS IN OUTDOOR RECREATION,
Bureau of Commercial Fisheries, Washington, D. C.
Virgil J. Norton.
Journal of Farm Economics, Vol 49, No 5, pp 1317-1320, December 1967. 4 p, 3 ref.

Descriptors: *Recreation, Welfare, Cost-benefit analysis, Risks, Constraints.
Identifiers: *Policy issues, Pareto optimality, Public policy, Labor mobility, Ignorance.

This paper refers to the previous paper by Frey and Gamble. The author considers the basic public policy question; what type, amount, and share of outdoor recreation services and facilities should the government provide. This question cannot be answered solely within the context of Pareto optimality. Economists doing research in the area of outdoor recreation must be aware that research results are utilized in decisions which result in welfare reallocation. It is important to provide an adequate information base so that all alternatives can be equally considered. To the extent that this has not been done, it is possible that the stage has been set for economic research results to misguide the allocation of outdoor recreation expenditures, not because of incorrect information but simply because of lack of sufficient data, particularly related to certain alternatives. The author suggests that research aimed at developing concepts for measuring recreation values of 'user-type' activities be encouraged. It is suggested that the role of government should be to eliminate constraints, (risks, uncertainty, lack of mobility, and ignorance), rather than to acquire or regulate property for outdoor recreational uses. The important role of water in outdoor recreation usage makes this article relevant to the water researcher. (Loeb-Rutgers)
W69-07178

EXTERNALITIES AND EMPIRICISM IN WATER RESOURCES,
Economic Research Service, Washington, D. C.
Adam A. Sokoloski.
Journal of Farm Economics, Vol 49, No 5, pp 1521-1525, December 1967. 5 p, 2 tab, 9 ref.

Descriptors: *Water resources, Management, Benefits, Oregon, Water quality, Demand, Costs, Fishing, Input-output analysis, Income.
Identifiers: *Externalities, *Empiricism, Group action, Price alteration, Inputs, Outputs, Market interaction, Secondary effects, Yaquina Bay, Engineering measures.

The purpose of this paper is to present one interdisciplinary technique which will supply empirical measures of external effects in water resources and their relation to group action and management. The paper follows the traditional delineation of technological and pecuniary externalities. However, the inclination to exclude the latter as a separate decision element is resisted. In the simplified example, firm A follows a production or consumption pattern which affects firm B, although B has no control over this situation. The effect on B results in price alterations in B's inputs and/or outputs and this in turn will reverberate through activities subsequently involving firm C in its dealings with B. There is the tendency among economists to relegate this interrelationship between B and C to the abyss of 'normal' market interactions. It is argued here that these pecuniary externalities, often referred to as secondary effects, are crucial to management policy. Isolating these effects within market interactions and relating them to the

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originating activity in common with the technological interaction will provide crucial assistance in the decision making process if empirical measures can be generated. The externalities usually assigned to 'water production' make this article relevant to the water researcher. (Loeb-Rutgers)
W69-07179

THE TVA TRIBUTARY DEVELOPMENT PROGRAM,
Arkansas Coll., Batesville.
Donald T. Wells.
University, Alabama, University of Alabama Press, 1964. 153 p.

Descriptors: *Tennessee Valley Authority, *Watersheds, *Resource development, Planning, Cost allocation, Benefits, Political aspects, Financing.
Identifiers: *Watershed management, *Watershed financing, *Beech River Authority, Tributary development, Resource mix, Tributary organizations.

The monograph is concerned primarily with the tributary area program of the Tennessee Valley Authority. The first chapter describes the background and development of the program within the TVA. The next chapter deals with the intergovernmental aspect of the watershed program. The monograph then discusses the various patterns of organization in watershed administration. The relationship between planning and watershed development is then examined. The economics of watershed financing are discussed in depth. Various methods of current financing are explained. The experimental methods in the Beech River Watershed are discussed in detail since they represent an attempt to develop a formula for the allocation of cost between the federal government and the Beech River Watershed Development Authority on the basis of estimated benefits. Discussions of inter-agency relationships, state and local politics and democratic control in watershed development follow. (Murphy-Rutgers)
W69-07183

WELFARE ECONOMICS AND SUBSIDY PROGRAMS,
Florida Univ., Gainesville.
Milton Z. Kafoglis.
University of Florida Monographs No 11, University of Florida Press, Gainesville, Florida, pp 1-83, Summer 1961. 83 p, 14 fig, 45 ref.

Descriptors: *Welfare, *Taxes, Income, Social values, Demand, Equilibrium, Pricing, Indirect benefits, Costs, Prices.
Identifiers: *Subsidy program, *Subsidy, *Highway finance, Conflict, Income distribution, Social marginal costs, Collective allocation, Social allocation.

This study attempts to select and apply a body of economic welfare criteria for the financing of those governmental programs which 'subsidize' private economic activity. The chief financial characteristic of such programs is that they rely on revenue derived from both prices and subsidies. Examples may be found in the transportation and public utility industries, the postal service, school programs, health and social insurance programs, programs for the protection and development of infant industry, and many others. In these areas, the subsidy and its corollary, the tax, represent values which the market either overlooks or deliberately rejects. Subsidies are granted and the required taxes are imposed on the assumption that the private or market production and consumption of goods and services will be altered so as to reflect certain social valuations. Subsidies and taxes, therefore, represent a difference between market and social valuation. But such payments cannot be determined efficiently until the unexpressed social magnitudes are at least defined and, if possible, measured. This study attempts to bring together into a systematic framework several strands of economic analysis--price theory, tax theory, and welfare economics. Public subsidy provides the focal point around which the framework is developed and highway finance provides the policy problem to which the framework is applied. Tax and subsidy programs have potentially large roles in water investment and development projects and accordingly this article is relevant to the theoretical evaluation of these programs in water resources problems. (Loeb-Rutgers)
W69-07186

THE MEASUREMENT OF SOCIAL WELFARE,
Northwestern Univ., Evanston.
Jerome Rothenberg.
Englewood Cliffs, New Jersey, Prentice-Hall, Inc, pp 1-357, 1961. 357 p, 19 fig, 8 tab, 284 ref, 6 append.

Descriptors: *Welfare, Value, Compensation, Taste, Marginal utility.
Identifiers: *Social welfare, *General Possibility Theorem, *Compensation principle, Value judgment, Kenneth Arrow, Social welfare function, Economic welfare function.

This book focuses on the question of what the fundamental criterion of social welfare must be in order that a developed welfare analysis can be relevant to guide policy decision. Three characteristics are considered appropriate. First, the standard must be internally consistent. Second, it must enable us to compare a large portion of the policy alternatives before use. Third, it must be compatible with relevant values prevailing in the community. The point of departure of the study is the finding by Arrow that if the standard be fashioned to reflect a particular interpretation of 'rational' evaluation and in addition bear the kind of correspondence to the values of the individuals in the community which we call consumer sovereignty, then the standard will necessarily be internally inconsistent. This book is partly an attempt to see how restrictive Arrow's finding is, and how best to by-pass it so as to form a useful analytic apparatus. Part I sets forth the basic problem and examines Arrow's analysis in detail. Parts II, III, and IV examine a wide variety of approaches in the welfare literature in order to discover how useful are the criteria of choice which they generate. The 'New Welfare Economics,' approaches introducing degrees of cardinality into individual utility indicators, and other approaches resting on specific group uniformities in individual preferences and on group value judgments concerning inter-personal comparability of social welfare impact are analyzed. The public good aspects and social welfare implications of water, water investment and water development projects make the subject matter of this study important to the water research area. (Loeb-Rutgers)
W69-07187

A SURVEY OF WELFARE ECONOMICS,
London School of Economics and Political Science (England).
E. J. Mishan.
Economic Journal, Vol 70, pp 197-265, June 1960. 69 p, 11 fig, 250 ref.

Descriptors: *Welfare economics, *Optimization marginal cost, Prices, Capital.
Identifiers: *Compensation tests, *Community welfare, *Indifference curves, *Welfare criteria, Consumer surplus, Marginal rate of substitution.

The author wishes to present a survey of the developments in the area of welfare economics. He is concerned only with the theoretical aspects and not in the application. Welfare economics involve the ranking of alternative economic situations open to society. Since it is concerned with community welfare it requires several ethical judgments, which are discussed. The author also devotes some time to the kind of methodology needed for such an analysis. The developments of the thirties and then from 1939 on are summarized. A major portion of the article is devoted to the controversy over welfare criteria with particular emphasis given to the contributions of Scitovsky, Little, Pigou, Samuelson and Arrow. The remainder of the article is devoted to the concept of consumer surplus. The author concludes with an evaluation of the inability of welfare economics in its present state to reveal the effects on human happiness of increasing affluence. In terms of the social welfare benefits of water resource development, this article provides a comprehensive summary of the theoretical literature of welfare economics. (Murphy-Rutgers)
W69-07190

BIOLOGICAL AND ECONOMIC ASPECTS OF FISHERIES MANAGEMENT,
Washington Univ., Seattle.
James A. Crutchfield.
College of Fisheries and the Department of Economics of the University of Washington at Seattle, February 17-19, 1959. 160 p.

Descriptors: *Foreign trade, *Fish management, *Fisheries.
Identifiers: *Management, *Political limitations, *Sociological limitations, *Economics in fishery management, Biology in fishery management, Halibut fisheries.

The book presents articles by different authors under several main headings. The first main section is on the biological and economic aspects of fishery management. This contains articles on management techniques available to fisheries management, biology and economics in fishery management, and the political and sociological limitations of fishery management. The second section deals with halibut fishery management and contains articles on management practices, economic effects of regulation, and the limitations of management. The third section deals with salmon management in Alaska with articles on the management and financial problems and the economic effects of regulation. The last section contains articles on international trade policies and their relation to fisheries. The articles within the section deal with the effect of trade on U.S. fisheries, recent developments in fishery methods and the effects of technological developments on the fishery industry. Since it is concerned with an important area of water resource planning this book should be a helpful reference to those working in the area. (Murphy-Rutgers)
W69-07191

ECONOMIC EFFECTS OF REGULATION OF THE PACIFIC HALIBUT FISHERY,
F. Heward Bell.
In Biological and Economic Aspects of Fisheries Management, College of Fisheries and the Department of Economics of the University of Washington at Seattle, pp 51-75, February 17-19, 1959. 75 p, fig 7, tab 6, ref 27.

Descriptors: *Prices, *Competition, *Fishery, *Management, *Regulation, Indirect costs, Capital, Population, Conservation.
Identifiers: *Production, *Yields, *Markets, Input-output ratio, Marine resources.

The article presents an answer to those economist who have claimed the management of the Pacific halibut fishery by the International Pacific Halibut Commission to be an economic failure. The gains in output by the regulated fishery are listed. The author answers the main criticisms of fishery management dealing mainly with the socioeconomic objections, questions relating to the type of markets in which the fish were disposed of and gives a lengthy discussion of the results of previous economic studies of the Fishery. The predictable and increasing production of the fishery provides a stabilizing element to the fluctuating Northwest fishing industry, thus benefiting the general regional economy. The joint regulation of the halibut fishery has been a highly successful experiment in management of an important water resource area bringing wealth, employment and food for the people of both Canada and the United States. (Murphy-Rutgers)

69-07192

NTERNATIONAL TRADE AND ITS EFFECT N UNITED STATES FISHERIES,
arold F. Cary.
Biological and Economic Aspects of Fisheries anagement, College of Fisheries and the Depart-ent of Economics of the University of Washing-n at Seattle, pp 130-141, February 17-19, 1959. 2 p, tab 4.

escriptors: *Foreign trade, *Fisheries, *Imports, Exports, Tuna.
entifiers: *Trade policies, Trade objectives, Sub-dies, Consumers, Processors, Distributors.

ne article explores the effects of international ade and trade policies upon the food fisheries. or the previous decade the domestic catch of food h has declined almost twenty per cent. At the me time imports of fresh and frozen food fish ve increased about one hundred and one per nt and that of canned and similarly processed fish nearly fifty-eight per cent. The author gives a ief outline of the United States trade policy over e last quarter century. The tariff arguments cur-ntly in force are discussed, with specific attention id to the tariff effects on groundfish fillets, frozen d canned tuna. There is also an explanation of e effects on United States fisheries of the trade olicies of other countries. The author concludes at the U. S. gives limited consideration as to the portance of its fisheries from the standpoint of stenance, trade and geopolitics and accordingly ts in limited ways. Whether this is in the national terest is a question that must be studied fully in e years immediately ahead. (Murphy-Rutgers)
69-07193

HE GENERAL THEORY OF SECOND BEST,
Lipsey, and K. Lancaster.
eview of Economic Studies, Vol 24, pp 11-32, ecember 1956. 22 p, 1 fig, 2 tab.

escriptors: *Optimization, *Optimum develop-ent plans, *Tariff, Price, Marginal costs, Con-raints.
entifiers: *Welfare economics, Trade, Multiple-yer optima.

this paper an attempt is made to develop a neral theory of second best. In Section I a verbal atement is given of the theory's main general eorem, together with two important negative rollaries. Section II outlines the scope of the neral theory of second best. Next, a brief survey given of some of the recent literature on the sub-ct. This survey brings together a number of cases which the general theory has been applied to rious problems in theoretical economics. The im-ications of the general theory of second best for ecemeal policy recommendations, especially in elfare economies, are considered in Section IV. llowing this are two examples of the application the theory in specific models and a rigorous oof of the central theorem. The paper concludes th a brief discussion of the difficult problem of ultiple-layer second-best optima. This article is e seminal treatment of welfare conditions in a n perfectly competitive environment and it has eoretical extensions to the welfare implications water resource and development programs. Murphy-Rutgers)
69-07194

C. Cost Allocation, Cost Sharing, Pricing/Repayment

N ANALYSIS OF ALTERNATIVE METHODS F FINANCING TYPES OF WATER ESOURCE FACILITIES IN MISSISSIPPI,
ississippi State Univ., State College. Water esources Research Inst.
uy T. Peden, J. R. Pulley, and J. L. Roberts.
ater Resources Research Institute, Mississippi ate University, 1968. 62 p, 1 fig, 16 tab, 21 ref, 3 ppend.

Descriptors: *Financing, *Municipal water, Mississippi, Government supports, Grants, Loans, Initial costs, Maintenance costs.
Identifiers: *Water associations, Farmers Home Administration loan, Bond issue, Operating revenue, Water facilities.

The analysis of 50 water association and 24 municipalities in central Mississippi had four objectives: (1) determine the type of water facility needed; (2) determine underlying factors causing this need; (3) determine the success of financing method used; and (4) determine and analyze problem areas resulting from the method of financing chosen. Three sets of questionnaires and follow-ups were used for Associations. Personal interviews with the Mayor, city, clerk, or a representative of either were used for municipalities. In financing original water systems, most associations utilized the terms of the maximum Farmers Home Administration loan. Deviations were small incorporated municipalities. Associations involved in improvements and/or extensions to their original systems are discussed. Problems of associations in obtaining funds and managing systems are discussed. After differentiating municipalities from associations, the report defines characteristics of the municipal study area. Types of facilities constructed and their costs are discussed. Methods of financing include: (1) private loan; (2) cash operating revenue, or retained earnings; (3) bond issue; and (4) government loan or grant. Existing source (s) of funds for each municipality are discussed. No common, general financing problems appear, but individual problems of different communities are discussed. (Gossen-Chicago)
W69-06856

RIGHTS, POWERS, DUTIES, MUNICIPALITIES.

Minn Stat Ann secs 465.18, 465.19, 465.26 to 465.29, 465.48, 465.49 (1947).

Descriptors: *Minnesota, *Ownership of beds, *Navigable waters, *Flood control, Cities, Rivers, Streams, Alteration of flow, Legislation, Navigation, Lakes, Dams, Water levels, Eminent domain, Condemnation, Taxes, Assessments, Government finance, Diversion, Channels, Dredging, Channel improvement, Nonnavigable waters, Regulation.

The ownership of beds of all navigable rivers in Minnesota is in the state, subject only to regulations of Congress and lawful public use. When any portion of the channel of such navigable river within the city limits of a municipality is changed by any authority for the improvement of navigation, and the city bears some of the cost of such change, the beds, abandoned due to the change, shall belong to the city. Larger cities may, for promotion of public welfare, divert any nonnavigable stream flowing within its limits from its natural bed to another channel. Cities may also regulate the flow of such streams by controlling discharge of lakes, and by improving the channels as necessary. The exercise of the power of eminent domain and the power to levy assessments is regulated. Certain cities have the authority to dredge lakes within their city limits, to maintain a water level therein and to park the shores of such lakes. Emerging flood prevention lands, financed through special tax levies, have been created in smaller cities. Larger cities are authorized to finance flood control measures by issuing bonds. (Wheeler-Fla)
W69-06935

A SHORT CUT TO CAPITAL BUDGET FORECASTING FOR PUBLIC UTILITIES,
J. F. Brennan.
Engineering Economist, Vol 14, No 3, pp 151-158, Spring 1969. 8 pp, 1 fig, 1 tab, 3 ref.

Descriptors: *Forecasting, *Budgeting, *Laplaces equations, Computers, Projections, Financial planning, Depreciation, Growth rates.
Identifiers: *Input data, *Optimization of capital structure, *Budget estimator, *Integral equation, *Parameters, Plant balance, Growth pattern, Frequency curve.

This article presents a method of forecasting the capital budget for public utilities on a short-term or long-term basis, through the use of Laplace transforms. This method was proposed as a short-cut around the mass of detail generally characteristic of such estimates. It is noted that certain elements of such budgets will always require individual attention; this method is designed to treat the majority of data en masse with acceptable estimating tolerance. To attain this, the capital budjet must provide for replacing equipment as it retires, provide for the subsequent replacement of the replacements, and provide for the new capital expenditures necessary to sustain the predicted growth. To achieve this ideal, this method suggests input data of only the present plant balance, its average age, estimated average life and growth pattern in the recent past. Computer time for a ten-year projection, by years, is less than ten seconds. This method can be quickly applied to meet a changing condition, such as inflation. Due to the importance of capital budgeting in water research and development this article suggests a method which may be used for water problems. (Murphy-Rutgers)
W69-07157

THE REGULATION OF QUEUE SIZE BY LEVYING TOLLS,
Technion - Israel Inst. of Tech., Haifa; and North Carolina Univ., Chapel Hill.
P. Naoy.
Econometrica, Vol 37, No 1, pp 15-24, January 1969. 10 p, 1 tab, 3 ref.

Descriptors: *Queueing theory, Profit, Costs, Income.
Identifiers: *Queue size, *Tolls, *Public good, Service station, Rewards, Traffic density, Laissez faire, Subsidies.

A queueing model--together with a cost structure--is presented, which envisages the imposition of tolls on newly arriving customers. It is shown that frequently this is a strategy which might lead to the attainment of social optimality. The basic features of the model are shaped by the assumption of the existence of a public good and by the assumption of possible non-admission of customers to the service station. Rewards are considered to be constant and equal. Again, no basically different results would have been obtained had these rewards been drawn from a distribution. A strong modification may be called for if it were assumed that the reward obtained depends in some way on the effective traffic density. It can be shown that a policy of 'laissez faire' is only rarely and accidentally a correct one. In this more general case, in which effective interaction between customers and therefore dependence on traffic density is assumed, the proper strategy is not necessarily the imposition of a toll. Cases can be constructed where the handing out of subsidies to joining customers optimizes public good. This article could be applicable to water problems due to the public good aspect of water and the problems of water allocation which might require a queueing type of approach. This article is also relevant to the admissions policies of water recreation sites. (Loeb-Rutgers)
W69-07168

ON THE NATURE AND SIGNIFICANCE OF SOCIAL COSTS,
Basel Univ. (Switzerland).
K. William Kapp.
Kyklos, Vol 22, Fasc 2, pp 334-347, 1969. 14 p.

Descriptors: *Economics, *Costs, Resource allocation, Air pollution, Public health, Market value.
Identifiers: *Social cost, *Social benefit, External economies, Neoclassical economics, Alfred Marshal, W Michalski, Public investment, Pigou, Christian Uhlig, Myrdal.

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This paper discusses the challenging difficulties to economic analysis presented by the problem of social cost. It remains doubtful whether these difficulties can be coped with adequately within the traditional boundaries of economic science. Neither the theory of resource allocation nor applied economics seem to provide adequate categories for the theoretical treatment of social costs or practical guidelines for their control. The concept of social costs, itself, was developed as an analytical instrument and as a critique of the method and scope of classical and neoclassical economic analysis. Social costs refer to consequences of productive activities and policy decisions which, for several reasons, carry an inevitable residuum of indeterminacy but which are nevertheless real and important, even though their approximate magnitude can be determined only after careful study which in many instances call for an evaluation based upon criteria other than market values. The author suggests wider concepts of social costs and social benefits than those that emerge from an attempt to incorporate these notions into traditional theory. Social costs are closely involved with water pollution problems and as such this article presents a general treatment of the economic basis of the social cost concept for the water researcher. (Loeb-Rutgers)
W69-07171

OPTIMAL SUBSIDIES AND TAXES WHEN SOME FACTORS ARE TRADED,
Massachusetts Inst. of Tech., Cambridge; Indian Ministry of Finance; Stanford Univ., Palo Alto, Calif.; and Indian Statistical Inst., New Delhi.
U. K. Ramaswami, and T. N. Srinivasan.
Jour Pol Econ, Vol 76, No 4, pt 1, pp 569-582, July/August 1968. 14 p, 2 fig, 10 ref, 2 append.

Descriptors: *Tariff, Welfare, Wages, Constraints.
Identifiers: *Optimal policies, *Revenue, Trade taxes, Consumption tax, Intermediate goods, Production function, Utility function, Subsidies, Outout diversification.

Trade taxes would secure revenue without welfare loss, instead of a uniform consumption tax, if factor supplies are inelastic. It is often not feasible, particularly in underdeveloped countries, to tax the consumption of much of home output. It is, therefore, of practical importance to determine the optimal policies for collecting specified revenue through trade taxes. It is shown in this paper that inputs used in export production must be free of duty in the second-best revenue tariff. It is also shown that optimal revenue duties on imports for home use will in general not be uniform. This does not, of course, mean that complex tariffs in the real world, which have been framed largely in response to pressures of interested groups, are optimal. What the conclusion suggests is that revenue tariffs should be based on objective empirical research. This conclusion could be applied to tariffs or fees on water traded interregionally or internationally whose main purpose was the raising of additional revenue. (Sokoloff-Rutgers)
W69-07172

THE INTERPRETATION OF VOTING IN THE ALLOCATION OF ECONOMIC RESOURCES,
Grinnell Coll., Iowa.
Howard R. Bowen.
Quarterly Journal of Economics, Vol 58, No 4, pp 27-48, November 1964. 22 p, 6 fig, 1 tab.

Descriptors: *Social needs, *Distribution patterns, *Costs, *Cost-sharing, Taxes, Education.
Identifiers: *Social goods, *Individual goods, *Ideal output, *Voting, Quantitative measurement, Marginal rate of substitution, Consumer choice.

The article begins with a comparison of individual goods with social goods. The bulk of economic thought has been devoted to individual goods. The author is attempting to show how certain portions of conventional economic theory may be adapted to problems relating to the production of social goods. The article proceeds to a formulation of the basic principles to guide the production of social goods, the application of these principles and the examination of problems in the distribution of costs. Thus, the alternatives for quantitative measurement of social goods are explained as well as the means for determining the ideal output of social goods. Voting in terms of a substitute for consumer choice in determining what social goods are to be provided and in what quantities, is discussed. The article concludes with a discussion of the problems of distributing social goods and their unequal benefits. Since water resources have public good components the problems discussed here have relevance to the water resource planner. (Murphy-Rutgers)
W69-07181

DECOMPOSITION, PRICING FOR DECENTRALIZATION AND EXTERNAL ECONOMIES,
Princeton Univ., N. J.; and Mathematica, Princeton, N. J.
W. J. Baumol, and T. Fabian.
Management Science, Vol 11, No 1, pp 1-31, September 1964. 32 p, 4 fig, 1 tab, 13 ref.

Descriptors: Linear programming, *Optimization, Constraints, Profit.
Identifiers: *Decomposition method, External economies, External diseconomies, Marginal yield, Multipliers, Decentralization, Dual prices.

The decomposition procedure for the solution of large scale linear programs is described in an elementary manner with illustrative calculations. Its economic interpretation as a procedure for decentralized decision by the multi-division firm or the multi-sector economy is explained in detail. Decomposition is shown to provide internal prices for decentralized decision making in the presence of external economies or diseconomies. However, it is demonstrated that in many cases there exist no prices which will lead divisions to make independent decisions that are optimal from the point of view of the company or economy as a whole. Of particular interest to the water resource researcher is the explanation provided of the way in which penalties and bonuses can be calculated and imposed to modify the price system in dealing with external economies and diseconomies. (Murphy-Rutgers)
W69-07182

MARGINAL COST PRICING IN PRACTICE,
Amherst Coll., Mass.
J. R. Nelson.
Englewood Cliffs, N. J., Prentice-Hall Inc, 1964. 266 p.

Descriptors: *Marginal costs, *Tariff, *Uncertainty, *Inflation, *Investment, Financing, Prices, Operating costs, Capital costs, Interest rates, Resource allocation, Budgeting.
Identifiers: *Marginal cost pricing, *Rate structures, *Cost dimensions, *Elasticity of demand, *Financial constraints, Decreasing costs, Increasing costs.

The book is a collection of translations of various French journal articles dealing with marginal cost pricing in the public utilities sector. The application of these pricing concepts is particularly useful in the water resource area. The first chapter provides a summary of the research conclusions of the basic tariff studies of Electricite de France as well as suggestions for future research and practical application. Chapter two provides an introduction into the principles of rate-fixing. Chapters three through six seek to define marginal cost and give demonstrations of how marginal cost is a function of demand. Following a discussion of load factor problems and the importance of time there is a chapter dealing with costs and prices based on uncertainty. Later chapters describe the application of the theory through the use of tariffs. A chapter is devoted to the complexities of water power. The final chapters discuss problems of pricing with given cost structures and cost minimization with maximum economy of operating and capital costs. This book provides for the water researcher a useful survey and treatment of both theoretical and applied issues in marginal cost pricing. (Murphy-Rutgers)
W69-07184

THE PROBLEM OF SOCIAL COST,
Virginia Univ., Charlottesville.
R. H. Coase.
The Journal of Law and Economics, Vol 3, No 4, pp 1-14, October 1960. 15 p.

Descriptors: *Cost sharing, *Pricing, *Government supports, *Welfare economics, Damages, Industrial production.
Identifiers: *Social costs, *Rights, Liability, Market transactions, Private product, Social product.

This paper is concerned with those actions of business firms which have harmful effects on others. The problem is how to avoid serious harm to any member of the community. This is the problem, for example, faced by the water resource planner in attempting to control the undesirable effects of commercial water usage or water development. The author discusses the role of the pricing system with and without liability for damage. The author attempts to take the cost of market transactions into account when considering a solution to the problem. A large section is devoted to Pigou's treatment of the problem with the conclusion that his position is somewhat unsatisfactory. Thus, the author concludes that the traditional approach based on this analysis is faulty and proposes a change which will consider the total effect of an economic action. (Murphy-Rutgers)
W69-07188

INTEGER PROGRAMMING AND PRICING,
Thomas J. Watson Research Center, Yorktown Heights, N. Y.; and Princeton Univ., N. J.
Ralph E. Gomory, and William J. Baumol.
Econometrica, Vol 28, No 3, pp 521-550, July 1960. 30 p, 9 fig, 6 tab, 13 ref, 2 append.

Descriptors: *Pricing, Linear programming, Fixed costs, Costs, Resource allocation, Constraints, Competition.
Identifiers: *Integer programming, *Method of integer forms, Dual prices, Shadow prices, Input, Output, Simplex method, Marginal valuation, Free good.

The method of integer forms (MIF) for solving integer programming problems is described. The paper discusses the pricing problem in the integer programming case--the case where, in economic terms, the inputs and outputs are not perfectly divisible. It is shown that the MIF algorithm produces a dual problem whose solution also inputs shadow prices to the scarce inputs. These prices possess a number of the properties of the dual prices of ordinary linear programming. In particular, they possess one of the most important properties of ordinary dual prices, that is, they permit the construction of a decentralized decision making arrangement which, in principle, will achieve some of the possible efficient allocations of resources. However, the price system no longer suffices to achieve every efficient allocation and when the consumer side of the market is taken into account the entire ideal output theorem of perfect competition runs into difficulties. Integer programming techniques have proven to be quite helpful in water research problems both in engineering and economic applications. This article in apply techniques to situations where inputs and outputs are indivisible has potential applications to the water resource area where this condition is constantly present. (Loeb-Rutgers)
W69-07189

6D. Water Demand

SOCIOECONOMIC FACTORS AFFECTING PARTICIPATION IN WATER-ORIENTED OUTDOOR RECREATION,
Missouri Agricultural Experiment Station, Columbia. Dept. of Agricultural Economics.
Durward Brewer, and Glenn A. Gillespie.
ERS-403, U.S.D.A. Econ. Res. Serv., Missouri Exp. Station, April 1969. 37 p, 25 tab, 3 fig, 1 append, 19 ref.

Descriptors: *Survey, Statistical methods, *Recreation demand, Recreation facilities.
Identifiers: *Socioeconomic characteristics, Analysis of variance, Duncan's test.

Socioeconomic characteristics can be used by public planners and private investors to estimate demand for water-oriented recreation. Important socioeconomic characteristics are annual family income, education, sex, race, age, occupation, and leisure time. About 67 percent of the families interviewed participated in water-oriented recreation. Through statistical analysis the affect of each socioeconomic characteristic on water-oriented recreation was measured. An appendix and a selected bibliography are included. (Grossman-Rutgers)
W69-06844

AN ECONOMETRIC MODEL FOR PREDICTING WATER-ORIENTED OUTDOOR RECREATION DEMAND,
Missouri Agricultural Experiment Station, Columbia. Dept. of Agricultural Economics.
Glenn A. Gillespie.
ERS-402, U.S.D.A. Econ. Res. Serv. Missouri Exp. Station, March 1969. 15p, 3 tab, 1 append, 1 bib, 5 ref.

Descriptors: *Demand, *Survey, Regression analysis, *Recreation demand.
Identifiers: *Socio-economic characteristics, *Econometric model.

The econometric model analyzes socio-economic characteristics associated with water-oriented outdoor recreation activities of people: annual family income, education, sex, race, age, and occupation. The information was obtained from interviews with 1,000 families in the St. Louis, Missouri area. The model makes possible estimations of future demand. However, the parameters may be different in other areas, and the parameters may change over time. The parameters will have to be re-assessed under these different conditions. (Grossman-Rutgers)
W69-06845

THE ECONOMIC SIGNIFICANCE OF COLUMBIA BASIN PROJECT DEVELOPMENT,
Bureau of Reclamation, Vancouver, Wash. Columbia Basin Project Office.
A. L. Walker, B. D. Parrish, H. O. Ward, O. L. Adams, and O. L. Brough, Jr.
Washington Agr. Exp. Sta., Coll. of Agr., Washington State Univ., Bulletin 669, Sept. 1966. 62 p, 12 map, 13 photo, 38 fig, 63 tab, 2 append, 6 ref.

Descriptors: *Columbia River Basin, *Economic impact, *Irrigation effects, Grand Coulee Dam, Dry farming, Land use.

The Columbia Basin Project is a multiple purpose development of water resources. The methodology used is to compare the economic growth in the Columbia Basin Project area with a non-irrigated dryland farming area which is similar to the project area except for irrigation. The report includes a description of the areas studied: natural resources, history, and project facilities. To determine the economic impact of the project the study examined the development of farm resources, the effects of agricultural development on non-farm economic activities, population, business and employment, postal receipts, consumption of electricity, telephone service, property values, tax receipts, public services, and complementary contributions from the Grand Coulee Power Plant and other areas. The report includes much statistical information, graphs, and two appendices. (Grossman-Rutgers)
W69-06848

WATER RESOURCES OF NORTH CAROLINA: BROAD AND CATAWBA RIVER BASINS.
North Carolina State Dept. of Conservation and Development. Div. of Water Resources, Inlets and Coastal Waterways.

Division of Water Resources, Inlets and Coastal Waterways, Volume VIII of XII volumes containing information regarding water resources of North Carolina, Raleigh, 1958. 138 pp, 320 tab.

Descriptors: *North Carolina, *Water resources, Municipal water, Agriculture, Industrial water, Water users, Electric power industry, Recreational facilities, Chemical properties, Water supply, Groundwater, Surface waters, Irrigation permits, Wells, Legislation, Streamflow, Water quality, Soil conservation, Navigation, Floods, Streams, Tributaries, Topography, Geology, Forest soils, Climatic data, Human population, Lumbering, Mining, Transportation, Mapping.
Identifiers: County governments, Muddy Creek Watershed Project.

The report describes the North Carolina watershed, including main streams, principle tributaries, topography, geology, forest cover, climate, population, industry, agriculture, lumbering, mining, transportation, mapping, watershed boundaries, and general information regarding counties. Chapters two-five discuss use of water for: domestic and municipal purposes; agriculture; industry; and, electric power and recreation. These discussions include descriptions and chemical character of public surface and ground water supplies in each county; data regarding agricultural production; a listing of irrigation permits; records of wells that supply water for industries; House Document No. 96, 73rd Congress, 1st session; generation of power by the Duke Power Co.; and a listing of recreational facilities. The sixth chapter gives streamflow records for fourteen locations. The seventh discusses the groundwater supply of the Statesville and Charlotte areas. Chapter Eight discusses quality of public water supplies and chemical character of surface waters at eighty-three locations. Chapter nine states stream sanitation policy and the powers and action of the State Stream Sanitation Committee. Chapter ten discusses soil conservation practices, the Muddy Creek Watershed Project, and its work plan. Chapter eleven discusses existing navigation projects; floods of July 1916, August 1928 and October 1929; and flood control in the Santee River Basin. (Gossen-Chicago)
W69-06852

SOCIOLOGICAL AND SOCIAL PSYCHOLOGICAL FACTORS RELATED TO METROPOLITAN WATER RESOURCES DEVELOPMENT,
Utah State Univ., Logan.
For primary bibliographic entry see Field 06B.
W69-06853

RESEARCH ON RECREATIONAL USE OF WATERSHEDS AND RESERVOIRS,
Public Health Service, Cincinnati, Ohio. Div. of Criteria and Standards.
J. Keith Carswell, James M. Symons, and Gordon G. Robeck.
J Amer Water Works Ass, Vol 61, No 6, pp 297-304, June 1969. 8 p, 5 fig, 2 tab, 13 ref.

Descriptors: *Water supply, *Recreation, *Reservoirs, Multiple-purpose projects, Aesthetics, Water quality, Behavior, Lakes, Psychological aspects, Public health, Recreation demand, Reservoir operation.
Identifiers: Reservoir use.

Studies of the effects of recreational use of watersheds and reservoirs on water quality and the question of whether such use should be permitted are reviewed. Although it is common practice to ban recreational use, several recent studies show that properly regulated recreation has no deleterious effects. Other studies show rather severe recreational pollution, most of which seems to be caused by lack of cooperation with the reservoir management, littering, unsanitary habits, and willful destruction and fouling. It is concluded that recreation need not be prohibited in many water-supply reservoirs, depending on local feelings, costs, and public willingness to obey sanitary regulations. (Knapp-USGS)
W69-07085

SCIENTIFIC INVESTIGATIONS PERTAINING TO THE PROBLEMS OF WATER ECONOMY (RUSSIAN).

Moscow, 'Nauka' 1968. 163 p.

Descriptors: *Water resources development, *Economic justification, *Water utilization, Water demand, Water sources, Water circulation, Canals, Irrigation, Artesian wells, Water properties, Water management, Hydrologic properties, Biochemistry, Water balance, Sea water, Exploitation.
Identifiers: *USSR, Water economy study.

This monograph is a collection of 86 abstracts for brief investigations mainly completed in 1963 and prior to this date on the use and conservation of water resources of the USSR. The papers and abstracts presented in this book can be subdivided into the following broad groups: (1) water resources and national economy water demand; (2) the study of qualitative and quantitative characteristics of water resources; (3) the basic data on quantitative distribution and qualitative transformation of water resources; (4) the study of water mass circulation and its effect on the surrounding medium; (5) methods for the construction of the scheme of total utilization of water resources; and (6) water economy structures, their evaluation and their exploitation. (Gabriel-USGS)
W69-07154

UTILITY AS A SURROGATE FOR VALUE IN WATER RESOURCES ANALYSIS,
Rutgers - The State Univ., New Brunswick, N. J.
For primary bibliographic entry see Field 06B.
W69-07158

INTERREGIONAL FEEDBACKS IN INPUT-OUTPUT MODELS: SOME EXPERIMENTAL RESULTS,
Pennsylvania Univ., Philadelphia.
For primary bibliographic entry see Field 06A.
W69-07161

ANALYTICAL ISSUES IN DEMAND ANALYSIS FOR OUTDOOR RECREATION,
Oregon State Univ., Corvallis.
Herbert H. Stoevener, and William G. Brown.
Journal of Farm Economics, Vol 49, No 5, pp 1295-1304, December 1967. 10 p, 2 fig, 1 tab, 12 ref.

Descriptors: *Recreation, Estimating, Demand, Welfare, Income, Marginal utility.
Identifiers: *Policy issues, *Research problems, Quantitative estimates, Option demand, Opportunity demand, Consumer surplus, Willingness to pay.

The current interest in analytical issues of evaluating the demand for outdoor recreation stems both from the need for policy guidance in this important area of resource allocation and from the recent

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quantitative work in estimating demand functions for outdoor recreational services. In this paper the authors attempt the following: First, they address themselves to a set of arguments which challenge fundamentally the idea of quantifying the demand for outdoor recreation. Second, they direct attention to some areas in which additional work appears to be necessary, if the general framework of economic analysis is accepted. They raise some analytical issues which appear to be relevant from a policy viewpoint. Some available empirical results are presented. The importance of water facilities in outdoor recreation make this article relevant to water resources research. (Loeb-Rutgers)
W69-07175

DISCUSSION: ANALYTICAL ISSUES IN DEMAND ANALYSIS FOR OUTDOOR RECREATION,
Utah State Univ., Logan.
B. Delworth Gardner.
Journal of Farm Economics, Vol 49, No 5, pp 1304-1306, December 1967. 3 p.

Descriptors: *Demand, *Recreation, Demand schedule, Resource allocation, Marginal utility, Welfare, Statistical methods, Costs, Pricing.
Identifiers: *Demand analysis, Price system.

This paper discusses the previous paper by Stoevener and Brown. In the study of outdoor recreation, economists have seemingly divided themselves into two camps. In the first group are those who believe that the price system should be used, directly or indirectly, in allocating resources to outdoor recreation. This group does not unanimously favor the imposition of use fees but does believe that at least surrogate prices should be estimated to guide resource commitments to recreation. The second group argues that, for various reasons, economics has little to contribute in this area. Recreation prices should be zero and the resource allocation decisions should be settled by political means. The author feels that Stoevener and Brown belong to the first group. Their paper is an attempt to answer some of the more serious objections of the 'detractors' of economics. Failure to use large doses of economics in allocating resources to outdoor recreation makes it impossible to detect bad management and gross inefficiency. The economic criteria used to assign benefit values to water oriented outdoor recreation has important impacts on the cost justification of many water projects. Accordingly, this article is relevant to water recreation planners in its argument for improving the economic framework of recreation pricing. (Loeb-Rutgers)
W69-07176

POLICY ISSUES AND PROBLEMS IN OUTDOOR RECREATION,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
For primary bibliographic entry see Field 06B.
W69-07177

DISCUSSION: POLICY ISSUES AND PROBLEMS IN OUTDOOR RECREATION,
Bureau of Commercial Fisheries, Washington, D. C.
For primary bibliographic entry see Field 06B.
W69-07178

6E. Water Law and Institutions

URBAN ENVIRONMENTAL PROBLEMS: ROLE OF THE FEDERAL GOVERNMENT,
Florida Univ., Gainesville. Water Resources Research Center.
Fletcher N. Baldwin.
Engineering Progress, University of Florida, Vol XXI, No 6, Bulletin No 128, pp 19-51, June 1967. 31 p, 173 ref.

Descriptors: *Federal jurisdiction, *Water law, Judicial decisions, Water rights, Federal-state water rights conflicts, Federal project policy, Riparian rights, State jurisdiction, History, Navigation, Florida, Water supply.
Identifiers: Federal constitution, Commerce Clause.

There are sufficient constitutional provisions and U.S. Supreme Court decisions to allow the federal government to establish a national policy of water regulation and control, and water law is slowly moving in that direction. Major discussion topics include: national policy and water rights in Florida and in the east, where water is still abundant; a history of federal water regulation; federal constitutional power; Supreme Court interpretation of the Commerce Clause; the first and second tests of navigability; the elimination of any opportunity for states to negate federal jurisdiction by compact with another state; initial effect of the Commerce Clause upon nonnavigable streams; limitation upon state and private water rights; extension of federal authority into nonnavigable waters; dominant federal servitude along navigable and nonnavigable waters; limitation upon federal 'taking'; and, the present status of the riparian owner in relation to federal projects on navigable and nonnavigable streams. In conclusion, the Supreme Court will have final say in interpreting federal water rights. It is probable that distinctions between navigable and nonnavigable streams will be practically eliminated. The water conflict is a dilemma that involves basic ideas of states' rights as opposed to national interests. (Gossen-Chicago)
W69-06842

THE SACRAMENTO DIVERTERS CONTROVERSY - A STUDY IN THE LEGAL ADJUSTMENT OF EXTERNALITIES,
California Univ., Los Angeles. Dept. of Economics.
David L. Shapiro.
Mimeograph report for presentation at Western Econ. Assoc., Cowallis, Oregon, Aug. 22, 1968; Dept. of Econ., Univ. of Cal., Los Angeles. 9 p, 5 tab, 1 append, 6 ref.

Descriptors: *Federal government, *Water law, Government finance, Supply.
Identifiers: *Trinity River Project, *Externalities, *Diseconomies.

Legal diseconomies resulted in a water supply shortage. Government aid tried to relieve these diseconomies, but the aid only created a new set of externalities. To relieve the shortage the Trinity River Project was planned. The history of this case is examined. (Grossman-Rutgers)
W69-06846

PROSPECTUS: WATERSHED PLANNING PROGRAM FOR BUFFALO AND MCDONALD CREEKS.
Harza Engineering Co., Chicago, Ill.
For primary bibliographic entry see Field 06B.
W69-06849

LEGAL RESEARCH IN WATER RESOURCES,
Office of Water Resources Research, Washington, D. C.
For primary bibliographic entry see Field 09D.
W69-06868

UNLAWFUL DAMAGE TO SAND DUNES AND OCEANSIDE BEACHES.

N Y Penal Law sec 1423-c (McKinney 1968).

Descriptors: *New York, *Dunes, *Beaches, *Shores, Legislation, Legal aspects, Public lands, Coastal structures, Shore protection, Damage.
Identifiers: Penalties (Criminal).

Any person who wilfully or maliciously removes, weakens, damages, or destroys any portion of a sand dune constructed with state or federal money, whether on private or public property, or on any shore of the state, shall be punished by fine, imprisonment, or both. It shall be unlawful to drive a vehicle over, upon, or along a sand dune unless a device sufficient to protect the dune from damage is used. (Shevin-Fla)
W69-06869

MALICIOUS INJURY TO AND DESTRUCTION OF PROPERTY.

N Y Penal Law secs 1425.8, 1425.12 (McKinney 1968).

Descriptors: *New York, *Oysters, *Lakes, *Poisons, Legislation, Shellfish, Damage, Rivers, Bay, Sound, Buoys, Boats, Beds, Ponds, Fish.
Identifiers: Piscivorous fish, Penalties (Criminal).

It is a misdemeanor to disturb an oyster or shellfish bed which is legally planted in any waters of the state or to destroy a stake or buoy designating the bed. A bed is legally planted when it is planted under the authority of the state or under a lease made with any town or city. A bed is legally marked when the owner can show that one or more stakes were placed at the corner of the bed at least 90 days before the offense was committed. Evidence showing that any boat or vessel was used to carry away oysters shall create a presumption of guilt against the owner, master, or crew of the vessel. It is unlawful to take, or attempt to take, without consent of the owner, any fish from a lake or pond that is situated so that the fish could not pass into it from any other body of water. It is unlawful to place any piscivorous fish or poisonous substance injurious to the health of the fish in any lake or pond without the consent of the owner. It is unlawful to let water out of a lake with the intent to take or harm the fish located therein. (Shevin-Fla)
W69-06870

DELAWARE RIVER BASIN WATER COMM'N COMPACT.

N Y Unconsolidated Laws secs 1581-1584 (McKinney Supp 1968).

Descriptors: *New York, *Delaware River Basin Comm'n, *State governments, *Interstate compacts, New Jersey, Pennsylvania, Delaware River, Streams, Surface waters, Dams, Reservoirs, Impounded waters, Riparian rights, Riparian lands, Eminent domain, Condemnation, Legislation, Water conservation, Water demand, Water resources development, Water supply, Water distribution (Applied), Public benefits, Legal aspects, Competing uses.

The Delaware River Basin Water Commission is comprised of three Commissioners, each appointed by the governor of his respective state. The federal government may be represented on the Commission by three advisory members. No action taken at any meeting of the Commission shall have force and effect until the governors of the signatory states are afforded an opportunity to approve or veto such action. The Commission is invested with all the rights and obligations inherent in natural persons and corporations for the effectuation of its authorized purposes. The Commission may acquire property within the Delaware Basin by eminent domain and condemnation proceedings. A signatory state's consent to the acquisition, occupation, and use of real property within its borders for maintenance of dams, reservoirs and related structures is required. The Commission is prohibited from transmitting hydroelectric power except for its own use. The Commission's activities may be financed by loans from the signatory states and by the issuance of negotiable bonds. The Commission shall endeavor to provide a common water supply and shall regulate such supply on the basis of equitable apportionment. (Katz-Fla)
W69-06871

DRAINAGE AND RECLAMATION OF LANDS.
N J Stat Ann secs 40:57-1 to 40:57-11 (1967).

Descriptors: *New Jersey, *Drainage districts, *Land reclamation, *Federal project policy, Federal government, Local governments, Administrative agencies, Drainage programs, Drainage systems, Dredging, Landfills, Cost allocation, Cost sharing, Taxes, Financing, Assessments, Maps, Cities, Riparian land, Swamps.

Chapter 57 of the New Jersey Statutes, entitled Drainage and Reclamation of Lands, consists of eleven subsections. Section one deals with the creation of municipal districts for reclamation and improvement of lands and with federal cooperation in that effort. Section two deals with cost allocation regarding such improvements and the duties of the State Board of Commerce and Navigation in furnishing a report and map. Section three concerns various procedural prerequisites the municipality must follow pursuant to obtaining federal assistance. Section four deals with the proceedings required upon failure of a municipality to join in such a proposed joint project. Section five enables dredged materials to be used as fill and authorizes the necessary entrance upon the lands to be improved. Section six concerns the financial and budgetary duties of a municipality in carrying out a project. Section seven concerns the application of receipts from assessments and the use of a tax levy or a bond issue if assessments prove insufficient. Section eight concerns the mode of municipal assessments of the lands benefited by these projects. Section nine deals with municipal assessments of riparian or submerged lands benefited. Section ten deals with the drainage of swamps and meadows. Section eleven establishes proceedings whereby small landowners may drain and improve their lands. (Carruthers-Fla)
W69-06872

FINDLEY LAKE PROPERTY OWNERS, INC V TOWN OF MINA (COMPETING USES).
154 NYS 2d 775-809 (Sup Ct 1956).

Descriptors: *New York, *Lakes, *Dams, *Proprietary power, Prescriptive rights, Reasonable use, Competing uses, Riparian rights, Riparian lands, Reservoir operation, Hydraulic structures, Mill dams, Streams, Aquatic weeds, Prior appropriation, Judicial decisions, Legal aspects, Remedies, Water level fluctuation, Water level, Water wells, Cities, Real property, Land tenure.
Identifiers: Injunctions (Prohibitory).

Plaintiff brought this action to evict a town board from certain premises and to permanently enjoin the board from constructing and maintaining gates at the plaintiff's damsite. The board contended that plaintiff's lowering of the lake level to make dam repairs and its poisoning of aquatic weeds threatened the recreational use of the lake, resulted in an unhealthful condition, and constituted a public nuisance. The court determined that the existence of a public nuisance was not proved beyond a reasonable doubt, as required by law, and held that the board's seizure of the dam site was not an abatement but a trespass. The board contended that the plaintiff's predecessors in title to the dam owned the right to use the impounded water only for generating power and that plaintiff's use of the dam for purposes of water level control was beyond the scope of the interest acquired. The court found an inherent inconsistency in the terms of the deed which justified consideration of the intent of the parties thereto. The court held that the parties intended the plaintiff to receive the right to use the impounded water for lake level control. (Katz-Fla)
W69-06873

RIVER DEVELOPMENT CORP V THE LIBERTY CORP (OWNERSHIP BELOW THE HIGH WATER MARK, LAND RECLAMATION).

45 N J Super 445, 133 A 2d 373-389 (1957).

Descriptors: *New Jersey, *Ownership of beds, *Boundaries (Property), *Patents, Leases, Proprietary power, Contracts, Tidal waters, High water mark, Low water mark, Submerged lands act, Dredging, Landfills, Riparian rights, Riparian lands, Land reclamation, Land tenure, Legislation, Legal aspects, Judicial decisions.
Identifiers: United Companies Act, General Riparian Act, Injunctions (Prohibitory).

The plaintiff sought to enjoin defendant from conducting dredging operations in certain tidal waters which plaintiff claimed to own. The plaintiff's claim was based on the United Companies Act which, plaintiff contended, granted the tidal land in question to his predecessors in title. The defendant contended that the Act merely vested plaintiff with a revocable license and was not a grant in fee. The defendant further contended that the state had revoked the license and had granted to defendant the privilege to conduct dredging operations. The court examined the Companies Act in pari materia with the General Riparian Act passed the same day. The court concluded that the Companies Act created a revocable right in the plaintiff to reclaim the lands in question but found that right had been revoked by the General Riparian Act and subsequent legislation. Public policy required that title to land beyond the high water mark be vested in the state. (Katz-Fla)
W69-06874

FAXON LAND CO V LAUBACH (SUIT TO ENJOIN BROUGHT AGAINST WRONG PARTY).

5 Lycoming 169, 7 D and C 32-34 (C P Lycoming County Pa 1956).

Descriptors: *Pennsylvania, *Jurisdiction, *Pipes, *Contracts, Road construction, Drainage systems, Legal aspects, Judicial decisions, Conduits, Surface runoff, Surface drainage, Damages, Maintenance.
Identifiers: Indispensible party, Trespass, Independent contractor.

Plaintiff sought to enjoin maintenance of a drain pipe which cast water upon his property. The defendant in this action was a contractor who constructed the pipe pursuant to contractual arrangements between himself and the Pennsylvania Department of Highways. The work was done at the direction and under the supervision of the Secretary of Highways. The court dismissed the bill on jurisdictional grounds, finding that the action should have been commenced in Dauphin County and that the Commonwealth was the proper party defendant. (Logan-Fla)
W69-06875

EMINENT DOMAIN - TAKING OR INJURY OF PROPERTY AS GROUNDS FOR COMPENSATION - NAVIGATIONAL SERVITUDE,
H. R. Weinberg.
Case W Res L Rev, Vol 19, No 4, pp 1116-1123, June 1968. 8 p, 45 ref.

Descriptors: *Riparian rights, *Eminent domain, *Condemnation, Appropriation, Federal government, Riparian land, State governments, Relative rights, Damages, Navigable waters, Judicial decisions, Legal aspects, California.
Identifiers: Navigational servitudes, Compensation.

The recent cases of United States v Rands, 389 U S 121 (1967) and Colberg, Inc v State, 432 P 2d 3, 62 Cal Rptr 401 (1967) deal with the navigational servitude. This servitude may be defined as the federal privilege to take private property without compensation because the taking is a result of the lawful exercise of a power to which private interests have always been subject. These cases extended the federal and state power to make any value in riparian land arising from the land's proximity to a navigable body of water subject to its exercise. In the future, it is unlikely that the U S Supreme Court will draw nice distinctions between various values in riparian land which arise from the flow of a stream. Under these decisions the courts may have extended the doctrine of the navigational servitude too far. They still have not articulated convincing or well-founded reasons to justify continued adherence to this principle. (Heckerling-Fla)
W69-06876

WHEATLEY V CASS COUNTY (ACTION TO PREVENT CONSTRUCTION OF DRAINAGE CULVERT UNDER HIGHWAY).

31 NW 2d 871-875 (Iowa 1948).

Descriptors: *Iowa, *Drainage systems, *Surface drainage, *Culverts, Relative rights, Judicial decisions, Easements, Channels, Surface runoff, Surface waters, Drainage water, Grading, Water law, Public benefits, Overlying proprietors, Local governments, Legal aspects.
Identifiers: Injunctions (Prohibitory).

Plaintiffs sued to enjoin the county supervisors from constructing a culvert under a highway at an existing channel location. Such a culvert, if installed, would alter the flow of surface water. The issue was whether the doctrine of equitable estoppel would apply in this case to justify prevention of the planned installation. Plaintiffs contended that they purchased their land after the grade and drainage system along the highway had been established and that, believing that no further construction would be undertaken thereon, erected valuable improvements which would be destroyed if the culvert was established. All parties recognized the right of defendant, as dominant owner, to discharge drainage water into a natural watercourse upon its land. However, there is no right to discharge water upon the servient estate in largely increased quantities, or at a different place or in a different manner than through the natural course of drainage. The appellate court affirmed the lower court's decision in favor of the county. The court held that plaintiff had failed to prove the necessary elements of reasonable reliance, deception and change of position. Plaintiff had also failed to show that material damage would result from the contemplated course of action. (Wheeler-Fla)
W69-06877

HUNT V SMITH (DAMAGE BY OBSTRUCTION TO NATURAL FLOW).

28 NW 2d 213-223 (Iowa 1947).

Descriptors: *Iowa, *Surface waters, *Watercourses, *Obstruction to flow, Surface drainage, Riparian rights, Legal aspects, Judicial decisions, Surface runoff, Floods, Rain water, Levees, Natural flow, Streams, Flood control, Repulsion (Legal aspects), Overflow, Dams, Riddance (Legal aspects).
Identifiers: *Swales, Des Moines River.

Plaintiff sought to restrain defendant from constructing a dam on his land which would obstruct the natural flow of water and cause it to back up on plaintiff's land. The defendant contended that he had an absolute right to repel surface waters. The court distinguished surface waters from watercourses which flow in a definite channel. The court further stated that the swale which defendant had dammed was a watercourse. A swale or depression through which surface water runs is a watercourse even though such depression or swale has no defined banks. The defendant had no right to obstruct the natural flow. When water flows in a well-defined course, its flow cannot be arrested or interfered with by the landowner to the injury of the neighboring proprietors. (Shevin-Fla)
W69-06878

AMORY V COMMONWEALTH (DAMAGES FOR DIVERSION).

72 NE 2d 549-561 (Mass 1947).

LIBRARY OF THE URBANA CHAMPAIGN

Descriptors: *Massachusetts, *Riparian rights, *Reservoir construction, *Eminent domain, Dams, Flood control, Legal aspects, Judicial decisions, Navigable streams, Rivers, Reasonable use, Federal government, Public benefits, Water supply, Diversion dams, Reservoirs, Hydroelectric plants, Flood damage, Benefits.
Identifiers: Measure of damages.

Plaintiff sought an assessment of damages against the State of Massachusetts for the taking and diversion of certain water in connection with the construction of a reservoir. In determining damages where no land has been taken, the benefits accruing to the land because of the diversion of water may be taken into account; however, in order to offset damages, a benefit must be shown to have accrued directly to the land by virtue of the public improvement. Since plaintiff's land was so situated that it was unlikely that the flood control benefits provided would accrue to it, no deduction from damages was allowable. The loss sustained by other similarly situated property owners could be used as a guide in assessing the amount of loss sustained by plaintiff. (Shevin-Fla)
W69-06879

JOINT COMMISSIONS FOR ALLEVIATION OF FLOOD CONDITIONS.

N J Stat Ann secs 40:69-51 to 40:69-10 (1967).

Descriptors: *New Jersey, *Legislation, *Administrative agencies, *Flood control, Civil engineering, Cities, Local governments, Financing, Legal aspects, Regulation, Floods.

Any two or more municipalities may establish, by ordinance, a joint municipal commission for the alleviation of flood conditions. The composition of such commission shall be 5 or more members, two appointed by the governing body of each municipality and one by the governor. All will serve for 5 years. The commissioners shall serve without compensation; only their expenses shall be paid. The powers of the commission are: (1) to employ all necessary clerical assistants, agents, workmen, and servants as necessary; (2) to determine the duties and compensation of employees; (3) to engage the services of competent engineering firms; and (4) to do all other acts necessary to alleviate flood conditions and to prevent floods. Municipalities may authorize appropriations for the use of the commission. The commission may expend funds appropriated to it in order to effectuate the purposes of this act. (Heckerling-Fla)
W69-06880

POWERS TO BE EXERCISED BY GOVERNING BODY OF MUNICIPALITY.
N J Stat Ann secs 40:69-4.7 to 40:69-4.12 (1967).

Descriptors: *New Jersey, *Legislation, *Cities, *Financing, Real property, Eminent domain, Condemnation, Operation and maintenance, Repairing, Legal aspects, Contracts, Local governments, Electric power.
Identifiers: Encumbrances, Bonds.

Any municipality having made an acquisition of real property as specified in this chapter may have full use and enjoyment of such property and may construct, erect, repair, and operate the same to the extent authorized in section 6 (a). It may also purchase electric current from outside sources. Any power conferred by this chapter on a municipality shall be exervised by its governing body, which body may act without a public referendum. Acquisition of property by eminent domain or condemnation is not authorized. Negotiable bonds and notes may be issued to finance the acquisition of property covered by this act. Section 4.11 makes the power to issue bonds and notes independent of the power to acquire property or to discharge encumbrances or claims thereon, nor will it be effected by the validity or regularity of the proceedings therefor, or the authorization therefor, or the cinancing transactions out of which such bonds or notes arise. Section 4.12 makes each section of this act independent and unaffected by the invalidity of any other section. (Heckerling-Fla)
W69-06881

RIGHTS ACQUIRED BY MUNICIPALITY IN RIPARIAN LAND.

N J Stat Ann sec 40:69-46 (1967).

Descriptors: *New Jersey, *Legislation, *Riparian rights, Cities, Local governments, Utilities, Public benefits, Water resources development, Contracts, Leases, Electric power, Electric power production, Power marketing, Legal aspects, Operation and maintenance.

In regard to property or other rights acquired under the provisions of this chapter, any municipality may: (a) make use of such property and rights, and sell or furnish water, electric current, etc to any public utility in the state, or to tenants of or in the immediate vicinity of the municipality; (b) enter into contracts with any public utility or any other person for the use and operation of such rights and property; (c) lease such rights and property to any public utility company or to any other person or persons; (d) sell so much of such rights and property which the municipality may find or determine are not needed by the municipality for a public purpose; (e) exercise, in whole or in part any and all of the alternative powers and privileges herein specified with respect to the said property and rights, or any part thereof. Any contract or lease may contain such terms as the governing body of the municipality deems proper and in the public interest, and such agreement shall run for a period not exceeding 50 years. (Heckerling-Fla)
W69-06882

MUNICIPAL ACQUISITION OF WATER RIGHTS.
N J Stat Ann secs 40:69-4.1 to 40:69-4.5 (1967).

Descriptors: *New Jersey, *Legislation, *Water rights, *Local governments, Cities, Riparian rights, Navigable waters, Nonnavigable waters, Legal aspects, Financing, Contracts, Conservation.
Identifiers: Encumbrances.

Section 4.1 defines the following terms: governing body, water rights, water power, water power rights, and water power property. Any municipality may acquire real property having appurtenant thereto riparian rights, 'water rights,' 'water power,' 'water powerrights,' and 'water power property,' together with real and personal property relating thereto. Title to land acquired in this manner shall pass to and vest in the municipality in as full and ample manner as the same was theretofore held and enjoyed by the person or persons owning the same. The above described acquisition may be made for such sum or sums, and upon such terms, covenants, and conditions, as may be agreed upon, and the property may be acquired subject to leases, mortgages, liens, and other claims, which may be performed or discharged by the municipality. The municipality may hold and retain so much of the said property so acquired as may be necessary for the conservation, regulation, use, or enjoyment of such real property. Property not needed for public use may be sold, leased, or otherwise disposed of. (Heckerling-Fla)
W69-06883

IMPROVEMENT OF CHANNELS IN NAVIGABLE WATERS.

N J Stat Ann secs 40:69-3, 40:69-4 (1967).

Descriptors: *New Jersey, *Legislation, *Navigable waters, *Channel improvement, Cities, Taxes, Local governments, Financing, Legal aspects, Cost allocation, Cost sharing, Contracts.

Any municipality bordering on a navigable stream may expend moneys for deepening or widening the channel of such stream. These moneys may be raised by taxation or by the sale of bonds. Any municipality may enter into an agreement with any other municipality bordering upon a navigable stream, or with the board of chosen freeholders of the county in which such municipalities are situated, or both, for the joint expenditure of such sums of money as may be necessary to accomplish the purposes provided for in section 40:69-3 of this title. The cost of carrying out these programs may be divided between the municipalities and the county in such proportions as may be agreed upon between them. (Heckerling-Fla)
W69-06884

ELIMINATION OF NATURAL BROOKS.
N J Stat Ann secs 40:69-1, 40:69-2 (1967).

Descriptors: *New Jersey, *Legislation, *Natural streams, *Financing, Local governments, Administrative agencies, Community development, Cities, Obstruction to flow, Drains, Legal aspects, Bridges, Culverts.

The governing body of a municipality may cover any natural stream or watercourse running through it and may change the alignment or course of such stream provided the water of such stream or watercourse is properly cared for and disposed of by a drain or drainage system. Whenever any such stream or watercourse crosses a public road over which the county would be obliged by law to build a bridge or culvert and the improvement o such stream or watercourse will render such bridge or culvert unnecessary, the county may contribute to the municipality such proportion of the cost of the improvement as it shall consider fair, after approval of the improvement plans by the board of freeholders. However, th improvements shall be done by the municipality. Bonds or notes may be issued to pay for the improvements. (Heckerling-Fla)
W69-06885

WATER AND WATERCOURSES.
N J Stat Ann secs 40:69-1 to 40:69-10 (1967).

Descriptors: *New Jersey, *Legislation, *Watercourses (Legal), *Cities, Administrative agencies, Natural streams, Local governments, Water rights, Riparian rights, Utilities, Community development, Public benefits, Water resources development, Eminent domain, Taxes, Costs, Drainage systems, Lease, Contracts, Flood control, Civil engineering, Navigable waters, Channel improvement, Legal aspects, Financing.

These sections pertain to the waters and watercourses within municipalities and permit: (1) the elimination of the natural brooks or a change of their course; (2) the cost of such improvement to be shared in by the county; (3) municipalities to improve channels in navigable waters; (4) joint municipal and county action to improve channels; (5) municipalities to acquire water rights; (6) disposition of property not needed; (7) and maintenance and repair of water power sources and purchase of supplementary power. These sections also give municipalities governing power with regard to properties acquired and permit the issuance of certain bonds. These sections also provide for the establishment of joint municipal commissions for the alleviation of flood conditions and sanction appropriation of funds to the commission to carry out their purposes. (Heckerling-Fla)
W69-06886

POLLUTION AND OBSTRUCTION OF WATERS.
N J Stat Ann secs 23:5-27, 23:5-28, 23:5-29, 23:5-29.1 (1940); N J Stat Ann sec 23:5-28 (Supp 1968).

Descriptors: *New Jersey, *Legislation, *Fish conservation, *Water pollution control, Fishkill, Wil-

dlife, Explosives, Fish ladders, Fish migration, Fish barriers, Fish toxins, Balance of nature, Drainage, Screens, Land reclamation.
Identifiers: Penalties (Civil).

New Jersey included pollution and obstruction of waters control measures under the state's fish and game laws. The article contained four sections. Section 27 prohibited use of drugs or explosives for taking fish, and imposed a fine of one hundred dollars. Section 28 prohibited allowing deleterious substances to run into state waters in quantities destructive to life or disturbing the habits of fish, under penalty of two hundred dollars. Section 29 prohibited shutting off, drawing off, and screening of waters without first obtaining permission from the State, with the fine set at one hundred dollars. Section 29.1 required that a fish ladder be installed on dams constructed in migratory fish runways, with the fine set at two hundred dollars. (Wheeler-Fla)
W69-06887

LANDS, WATERS AND INTERESTS THEREIN; CONDEMNATION; OUTSTANDING INTERESTS; ENTRY AND EXAMINATION.

40 N J Stat Ann sec 60-2 (1967).

Descriptors: *New Jersey, *Local governments, *Municipal water, *Real property, Water rights, Legislation, Easements, Property values, Legal aspects, Water law, Condemnation, Eminent domain, Right-of-way, Cities, Contracts, Surveys, Data collections, Terrain analysis.

Every municipality may acquire, by gift, devise, purchase, or condemnation any real estate, and any easements, materials, waters, water rights, or other property, and any interest or estate whatsoever therein, either within or without the municipality, or any outstanding easement, right or interest in any real estate, in its possession, which its governing body shall decide to be necessary or useful for the proper exercise of any power conferred upon the municipality by this or any other law; but this section shall not operate, or be construed, to repeal or supercede any law requiring the consent of any other municipality, or of any state authority for the acquisition of any property, or rights, easements, or interests. Any such municipality proposing to acquire any such property, or any such rights, easements, or interests may enter upon the same at any time, by its engineers, surveyors and agents, to make reasonable examinations, surveys and explorations, being liable to the owner and tenants for all damage and injury. (Carruthers-Fla)
W69-06888

INTERSTATE SANITATION COMMISSION - TRI STATE COMPACT.
N J Stat Ann secs 32:18-1 to 32:18-22 (1963).

Descriptors: *New Jersey, *Water pollution control, *Interstate compacts, *Interstate commissions, pollution abatement, public health, water pollution treatment, sewage treatment, Water quality control, State governments, Water policy, Sanitation, New York, Connecticut, Administrative agencies, Legislation.

Because of the tremendous growth of population and rapid development of industry surrounding the New York harbor area, the problem of pollution has become increasingly serious. It now constitutes a grave menace to the health, welfare, and recreational facilities of people living in the area. Since control of future pollution and abatement of existing pollution is of such prime importance to the people of the area, it was felt that the problem could best be solved through cooperation of the States of New Jersey, New York and Connecticut. Consequently, an interstate compact was created to handle the problem. It set up the machinery to cope with the widespread polluted areas. Each state pledged its faithful cooperation in fulfilling the objectives of the compact. This necessitated money, legislation, and regulation from each. It is hoped that with this compact and a combined effort by each state, pollution can be controlled. (Stewart-Fla)
W69-06889

JONES V PENNSYLVANIA RR (DAMAGES CAUSED BY DIVERSION OF WATER).
75 SE 2d 103-106 (W Va 1953).

Descriptors: *West Virginia, *Diversion, *Alteration of flow, *Stream erosion, Judicial decisions, Streamflow, Damages, Obstruction to flow, Barriers, Riparian rights, Bank erosion, Floods, Legal aspects.

Defendant negligently obstructed and diverted the waters of a creek onto the plaintiffs' property causing erosion and damage to the foundations of plaintiffs' dwellings. During one spring, the stone wall forming the north bank of the creek disintegrated at certain points opposite the dwellings of the plaintiffs. Defendant, in making repairs, dumped quantities of stone blocks into these gaps, and some of these blocks extended into the stream. These obstructions caused damages by undermining and washing away parts of plaintiffs' land. The trial court returned a verdict for the plaintiffs on the basis of permanent damage; defendant appealed the verdict and assigned as error the amount of the damage award. The court held that the right of the plaintiff to recover permanent or temporary damages was determined by the nature of the obstruction and not the damage which has been suffered. The fact that the nuisance complained of had been removed prior to trial was held to be conclusive evidence of the temporary nature of the obstruction. The verdict was set aside since no evidence was offered as to the cost of repair, the expenses directly occasioned by injury, or the compensation for loss of use or rent. (Heckerling-Fla)
W69-06891

JOINT WATER SUPPLY AND WASTE DISPOSAL SYSTEMS.
Mich Comp Laws Ann secs 123.381 to 123.384 (1967).

Descriptors: *Michigan, *Waste disposal, *Water supply, *Local governments, Waste treatment, Financing, Pipelines, Contracts, Sewage disposal, Inter-agency cooperation, Legislation, Cities, Regulation.

Any local unit of government, including any county, city, village, township, school district, port district, metropolitan district or other governmental unit, may enter either singly or jointly into contracts with local units of government in another state to construct, maintain, and operate waste disposal systems including sewers, intercepters, or waste treatment facilities, and water supply systems such as pipelines, pumping, treatment and distribution facilities. Contracts may provide for location of these systems in Michigan or in another state and may be on any terms not contrary to the laws of Michigan. Contracts may also provide for waste disposal or water supply by means of facilities in either state, and local units of government may finance such systems pursuant to the laws of Michigan. (Harris-Fla)
W69-06892

FEDERAL POWER COMM'N V OREGON (FEDERAL POWER PROJECT).
349 U S 435-457 (1955).

Descriptors: *Hydroelectric plants, *Federal-state water rights conflicts, *Dams, *Oregon, Judicial decisions, Legal aspects, Streams, Alteration of flow, Reservoirs, Public benefits, Recreation, Anadromous fish, Fish conservation, Spawning, Dam construction, Public lands, Columbia River, Water storage, Water utilization, Obstruction to flow, Indian reservations, Federal government, State governments.
Identifiers: Deschutes River, Commerce power.

The Federal Power Commission issued a license permitting a power project to use waters from a United States reservation located in Oregon. The state challenged the Commission's authority. The authority to issue licenses relating to use of navigable waters of the U S springs from the Commerce Clause of the Constitution. The project is to occupy reservations, as distinguished from public lands, and thus, since title to the lands is held by the United States, no state authorization is necessary, provided the use of the water does not conflict with the vested rights of others. The Desert Lands Acts of 1866 and 1870, upon which the state relied for authority, were not applicable since they applied to public lands, not to reservations. The project has provided for a 'reregulating dam' to control interruptions in the natural flow of the stream. The state also challenged the adequacy of provisions for the conservation of anadromous fish. The fish would be cut off from their natural breeding grounds, but the power company had agreed to provide facilities for conserving the runs of anadromous fish, thus satisfying state requirements. The court found that the Commission had acted within its powers in issuing the license. (Shevin-Fla)
W69-06893

FLOOD V EARLE (WAYS OF NECESSITY FRONTING ON A NAVIGABLE LAKE).

71 A 2d 55-58 (Me 1950).

Descriptors: *Maine, *Great ponds, *Navigable waters, *Right of way, Easements, Ponds, Lakes, Public benefits, Public rights, Access routes, Legal aspects, Judicial decisions, Water law, Nonnavigable waters, Real property, Land tenure, Prescriptive rights.
Identifiers: Trespass.

An action in trespass was brought against defendant for traveling across plaintiff's land. The action was referred to a referee who found defendant and plaintiff owned adjacent cottage lots on the shore of Messalonskee Lake, a great pond. These lots had originally been part of a large farm. Defendant's predecessors in title had purchased his lot in 1906; his was the first shore lot sold. The referee ruled that since 1906 defendant and his predecessors have had an implied way of necessity for the main highway to their lot and that this way had been located in part on plaintiff's lot. Plaintiff excepted to the adoption by the court of the referee's report. The court held that if free access to the land over a public navigable water exists, a way by necessity cannot be implied. However, whether a body of water can be used as a highway is a fact question. The referee had a first hand opportunity to determine whether the lake was a navigable highway and whether defendant had free access to the lake from the main road. The court could not say that the referee was not justified in his findings. (Gabrielson-Fla)
W69-06894

WHITE V WABASH RR (ACTION FOR DAMAGES DUE TO ALLEGED DIVERSION OF SURFACE WATERS).

207 SW 2d 505-511 (Mo Ct App 1947).

Descriptors: *Missouri, *Relative rights, *Repulsion (Legal aspects), *Flow augmentation, Surface waters, Surface runoff, Judicial decisions, Rainfall-runoff relationships, Drainage systems, Natural streams, Drainage effects, Drainage engineering, Rainwater, Natural flow, Railroads, Embankments, Legislation, Local governments, Riddance (Legal aspects), Surface drainage, Damages, Diversion.

Plaintiffs brought this action to recover damages sustained because of an alleged diversion of surface waters by the defendant onto and over a farm owned by plaintiffs. Plaintiffs, contended that defendant, in constructing a spur line, had knowingly and unlawfully diverted surface waters from land adjacent to plaintiffs, and, by artificial means, cast water into a branch creek causing it to overflow

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and damage plaintiffs' property. The court held that the common law rule that a landowner may guard against and repel surface water, provided he exercises reasonable care in so doing, was applicable in this jurisdiction. Each proprietor is permitted to protect his land against surface water which is the common enemy of all. Plaintiffs' contention that even under this doctrine defendant could not use artificial means to discharge the water onto a neighboring estate was overruled in light of a statute requiring railroad companies to construct suitable ditches to drain surface water into other ditches, drains, or watercourses along their roadbeds. Since plaintiffs' action was based on alleged unlawful actions, and not upon negligence, even though the volume of water in the natural watercourse was substantially increased, the suit failed. (Kelly-Fla)
W69-06895

FULTON V TOWN OF BELMONT (DAMAGE FROM OVERFLOW OF STORM DRAINS).
127 NE 2d 569-572 (Mass Sup Ct 1955).

Descriptors: *Massachusetts, *Surface drainage, *Drains, *Cities, Damages surface waters, Flood damage, Ditches, Pipes, Drainage systems, Conduits, Seepage, Percolating water, Storm drains, Drainage water, Excess water (Soils), Surface runoff, Sewers, Culverts, Judicial decisions, Legal aspects.
Identifiers: *Catch basins, Injunctions (Mandatory).

Plaintiffs were landowners in defendant town. Along the street on which plaintiffs reside was an elevation called a berm, designed to carry surface water to two catch basins at a low point in front of plaintiffs' property. One of the catch basins was drained by a pipe running under plaintiffs' property. The drain and pipe had been requested and installed by plaintiffs' predecessor in title in order to conduct the surface and percolating water from the catch basins to the rear of the property. The city furnished the pipes for the drain. Subsequent owners, including plaintiffs, allowed the drain to remain. Plaintiff sought a mandatory injunction requiring removal of the drains and a damage award for flood damage due to faulty drainage. The court held that defendant had a right to build the catch basins in order to keep the street in repair and safe for travel and that it would not be liable for any water therefrom which floods nearby land. Adjoining landowners may erect drains to prevent flooding of their land, but the city is not responsible for negligent construction thereof because the drain is in the control of the landowner. (Helwig-Fla)
W69-06896

THOMAS V HOLMES (RIGHT TO USE WELL WATER).

306 Ky 632, 208 SW 2d 969-973 (1948).

Descriptors: *Water contracts, *Wells, *Easements, *Kentucky, Water rights, Distribution, Proprietary power, Remedies, Pipelines, Pipes, Judicial decisions, Legal aspects, Usufructuary right, Damages, Relative rights, Real property, Pumping, Contracts.

Appellee, in selling the smaller of two adjoining lots, included a provision in the deed retaining the right to use water from a well situated on the lot conveyed. In 1945, this lot was conveyed to appellant. At that time, a pump, originally installed by the appellee, supplied well water to both of the lots. Later, having purchased a new pump for the well, appellant advised appellee that he would cease pumping water for appellee's use. Appellee sued to enjoin such threatened action and to recover damages for interference with his use of the well and the pump on appellant's lot. The chancellor found that appellee had a right to use the pump provided he paid one-half of the cost of the new pump and for one-half of the pump's electricity. The appellate court reversed, holding that appellee had a right to use the well water and that this right comprehended the ability to do all things reasonably necessary in order to perfect such right, to wit installing his own pump. However, there was no binding agreement allowing appellee to use appellant's pump, and the chancellor could not create such a contract for the parties. (Gabrielson-Fla)
W69-06897

FLOOD COVERAGE: NEW CHALLENGE FOR INSURANCE.
For primary bibliographic entry see Field 04A.
W69-06898

POYNTER V COUNTY OF OTTER TAIL (LIABILITIES RESULTING FROM CONSTRUCTIONS OVER WATERCOURSES).
25 NW 2d 708-718 (Minn 1947).

Descriptors: *Minnesota, *Obstruction to flow, *Floods, *Culverts, Judicial decisions, Damages, Water law, Legal aspects, Natural flow, Natural streams, Highways, Estimating, Maximum probable flood, Roads, Construction, Dams.
Identifiers: Proximate cause.

Plaintiff brought suit claiming that defendant had negligently constructed a highway culvert which obstructed the natural flow of Otter Tail River and that such obstruction was the proximate cause of damage to plaintiff's crops. Twenty-five years prior to the highway construction, a dam had been built on the river which diverted much of the river water and substantially reduced the size of a stream flowing adjacent to plaintiff's tract. It was over this stream that the highway in question was constructed. The culvert was constructed to accommodate the flow which had been constant for the past twenty-five years. The damages claimed occurred after a period of unprecedented flood. The court, stating that one who erects a structure across a waterway must adequately provide for the passage of waters reasonably expected to flow thereunder, held that defendant, in relying upon conditions existing for twenty-five years, was not liable for damages caused by obstructing the natural flow when such flow resulted from an unprecedented flood. (Holt-Fla)
W69-06900

CITY OF PASSAIC V CITY OF CLIFTON (COORDINATED FLOOD CONTROL PLANS).

14 N J 136, 101 A 2d 530-535 (1953).

Descriptors: *New Jersey, *Flood control, *Cities, *Administrative agencies, Legal aspects, Flood protection, Judicial decisions, Streams, Culverts, Flow augmentation, Runoff, Permits, Construction, Regulation, Natural flow, Relative rights, Costs.
Identifiers: Box culverts.

Plaintiff city of Passaic petitioned the Division of Water Policy and Supply to impose conditions on permits granted to defendant city of Clifton which gave authorization to construct flood control devices in a natural stream which had its source in defendant city and flowed through plaintiff city. Plaintiff stated that defendant's improvements would increase the stream's velocity of flow and that the increase would require plaintiff to make additional expenditures in connection with its own flood control plans. The petition was denied, and plaintiff appealed. The supreme court affirmed, stating that the two cities' plans provided a coordinated, practical, and economical solution to the problem of flood control on the stream. The court noted that the expense of alternatives to defendant's plan was prohibitive, while the cost of altering plaintiff's program to accommodate defendant's activities was relatively small. (Sisserson-Fla)
W69-06901

JACOBSON V KANDIYOHI (CONSTRUCTION OF A DRAINAGE DITCH).

48 NW 2d 441-445 (Minn 1951).

Descriptors: *Minnesota, *Drains, *Drainage programs, *Ditches, Local governments, Lakes, Drainage effects, Drainage systems, Dams, Judicial decisions, Legal aspects, Damages, Flooding, Water rights, Artificial watercourses, Administrative agencies, Administrative decisions, Legislation, Water levels.

This is an appeal from the district court's order vacating an order of a county board establishing a county ditch. The supreme court upheld the lower court's finding since the proposed ditch would drain into a previously completed ditch in an increased amount to the damage of adjacent property. Once a ditch system is established, the order creating it constitutes a judgment in rem. The res of the order is the watercourse and all lands damaged or benefited by it. Since the landowners involved in the construction of the first ditch were not parties to this proceeding, the order of the board was without authority. Further, under section 106.021, subd 3, the board was without power to establish the ditch without authority from the commissioner of conservation where, as in this instance, its construction would affect the level of a connected lake. Finally, a member of the county board was disclosed to be an interested party to the proceedings. (Kahle-Fla)
W69-06903

SWOBODA V RENVILLE COUNTY (PROCEEDING TO ESTABLISH VALIDITY OF PETITION FOR A DRAINAGE DITCH).
62 NW 2d 816-822 (Minn 1954).

Descriptors: *Minnesota, *Drainage systems, *Eminent domain, *Land tenure, Local governments, Relative rights, Controlled drainage, Drainage programs, Drainage water, Surface waters, Rain water, Drains, Ditches, Judicial decisions, Ravines, Artificial Watercourses, Easements, Condemnation, Riddance (Legal aspects).

This proceeding was to determine whether an amended petition filed with the county board for establishment of a drainage ditch fulfilled the statutory requirement that such a petition must bear the signatures of the owners of fifty-one per cent of the land traversed by the ditch. Appellant contended that the county had not secured the signatures of several 'owners' of land necessary to meet the percentage requirement. The court found that appellant's contentions were unfounded and held that owners of the land traversed by a natural waterway which would become part of the drainage system without improvement to the natural waterway were not necessary parties to the signing of the petition. Their land was not to be counted in the computation of the percentage necessary to render the petition valid. The court also held that mortgagees of real estate, vendors of real estate, the county which held a two rod easement over part of the proposed path of the ditch, and the seller of land who gave a warranty deed and guaranteed to make good to the buyers any assessment for the proposed ditch, were not 'owners' within the meaning of the statute. (Kelly-Fla)
W69-06904

WHITE CAP SEA FOODS, INC V PANZNER (RIGHT TO USE A CANAL).
1 App Div 2d 963, 150 NYS 2d 322-323 (Sup Ct 1956).

Descriptors: *New York, *Canals, *Docks, *Boat, Judicial decisions, Legal aspects, Channels, Barriers, Riparian rights, Riparian land, Riparian waters, Relative rights.
Identifiers: Catwalks, Injunctions (Prohibitory), Injunctions (Mandatory).

Plaintiff's predecessors in interest had been conveyed the right to use a canal. The lower court held that plaintiff was thus allowed to use the canal for reasonable ingress and egress of craft to his dock for loading and unloading. The defendant was required to remove a catwalk and certain poles which interfered with the plaintiff's use of the dock and was enjoined from interfering with the use of the waterway. The appellate court affirmed the lower court opinion requiring the defendant to remove the obstacles which interfered with the plaintiff's use of the dock; however, the lower court's opinion was modified to an extent by the appellate opinion which specified that plaintiff was not to use his rights in the canal in such a way as to interfere with the defendant's use. Thus, each party was to have free use of the waters as long as they did not interfere with the rights of the other. (Shevin-Fla)
W69-06906

ERA OF MILITANT FISHING JURISDICTION - STUDY OF THE FLORIDA TERRITORIAL WATERS ACT OF 1963,
Dorian Cowan.
U Miami L Rev, Vol 23, No 1, pp 160-181, Fall 1968. 22 p, 156 ref.

Descriptors: *Jurisdiction, *Florida, *Submerged Lands Act, *Ownership of beds, Littoral, Legislation, Federal jurisdiction, State jurisdiction, Continental shelf, Commercial fishing, Political aspects, International law, International waters, Boundaries (Property), Governments, Legal aspects, Water law, Shores, Fishing, Coasts.

The economic importance of off-shore waters and beds has quickened the interest of the maritime nations in extending their jurisdiction over coastal waters and beds. In the United States, the controversy is over whether the coastal states of the federal government have title to the adjoining seas and beds. Under the Federal Submerged Lands Act, title to the ocean beds was declared to be in the states. Earlier, the court had acknowledged that regulation of coastal fishing was a proper exercise of state police powers only where there was no conflict with federal regulations. Federal regulation was authorized for the purposes of commerce, national defense, and international affairs. Because unrestricted fishing was regarded as a serious threat to national resources, both the United States and the state of Florida passed laws requiring the licensing of foreign fishing vessels. The Florida Territorial Water Act of 1963 denies fishing privileges to the communist community of nations. Licenses are issued on the basis of reciprocity and friendly, neutral nations are favored. It is submitted that questions of constitutionality and conflict with federal fishing regulations the exigencies of national foreign policy will preclude a frequent application of this statute. (Gabrielson-Fla)
W69-06907

TROSCLAIR V SUPERIOR OIL CO (DAMAGES TO OYSTERS FROM OIL CONTAMINATION).
219 So 2d 278-282 (La Ct App 1969).

Descriptors: *Louisiana, *Oysters, *Oil wells, *Water pollution, Reasonable use, Leases, Drilling, Civil law, Judicial decisions, Oil wastes, Water pollution, Sources, Water pollution effects, Saline water, Reefs, Damages, Seashores, Mineral industry, Overflow, Legal aspects.

Plaintiff brought this action to recover damages for the loss of oysters through oil contamination. Plaintiff alleged that the overflow of oil and waste from a pit used in connection with defendant's drilling operations caused plaintiff's oysters to taste oily and rendered them unmarketable. The court held that the plaintiff failed to support its burden of proof as to defendant's negligence in the alleged overflow. The court found that in light of testimony to the effect that the oysters would have purged themselves of the taste in two or three weeks, plaintiff failed to sufficiently prove his damages. The court further found that even if defendant's oysters had been contaminated by oil overflow, the mineral lease held by defendants was prior in time and right to the oyster bed lease. Therefore, plaintiff would have the burden of showing that defendant had acted in an unduely negligent manner in the working of its mineral lease. (Kelly-Fla)
W69-06908

MADISON METROPOLITAN SEWERAGE DIST V COMM ON WATER POLLUTION (DISCHARGE OF SEWAGE INTO LAKE WATER).
260 Wis 229, 50 NW 2d 424-439 (1951).

Descriptors: *Wisconsin, *Sewage effluents, *Water pollution control, *Local governments, State governments, Biochemical oxygen demand, Odor-producing algae, Pollution abatement, Sewage treatment, Sewage disposal, Waste disposal, Water pollution, Lakes, Streams, Sewage, Remedies, Judicial decisions, Legal aspects.

Petitioner sewerage district, a public corporation, discharged the effluent from its sewage treatment plants into surrounding lakes. The inorganic chemicals contained in the effluent contributed substantially to the abnormal growth of a type of algae which created objectionable conditions in those lakes. Respondent, a public agency acting under powers granted by the legislature ordered petitioner to modify and improve its sewage disposal system so as to eliminate the algae nuisance. The circuit court affirmed the lower court's order and petitioner appealed. The supreme court held that the right of a municipality to empty its sewage into a stream or river was merely a legislative license revocable whenever public health and safety required. The respondent did not have to state expressly that appellant was creating a nuisance when its findings substantially demonstrated that a nuisance existed as a result of appellant's operations. (Gabrielson-Fla)
W69-06909

BUNDY V CITY OF SULLIVAN (ARTIFICIAL CONTROL OF SURFACE DRAINAGE).
1 Ill App 2d 212, 117 NE 2d 302-303 (1954).

Descriptors: *Illinois, *Natural flow, *Drainage systems, *Flood damage, Cities, Drainage water, Artificial watercourses, Natural streams, Surface waters, Surface drainage, Surface runoff, Judicial decisions, Watercourses (Legal), Ditches.

Plaintiff brought this action to recover for damages caused by the draining of water onto his land. The defendant had constructed a large artificial ditch and had connected it with another ditch which led directly onto the plaintiff's land. As a result of this network of ditches, drainage water from the defendant's streets was channeled onto the plaintiff's property. The plaintiff alleged that surface waters can not be drained through artificial channels onto the land of another. However, the court held that the decisive question was not whether the drainage system was artificial but whether it altered the general course of natural drainage. The plaintiff's complaint failed to allege that the defendant's system detrimentally altered the natural drainage. Futhermore, the plaintiff elected not to amend his complaint. Judgment for the defendant was affirmed. (Stewart-Fla)
W69-06910

MITCHEL V DOVER (BACKWATER IN SEWERAGE SYSTEM).
99 A 2d 409-412 (NH 1953).

Descriptors: *New Hampshire, *Sewers, *Backwater, *Drains, Obstruction to flow, Sewage, Local governments, Sewage disposal, Sewage effluents, Remedies, Damages, Judicial decisions, Legal aspects, Operation and maintenance.
Identifiers: Questions of fact, Causes of action, Nonsuit, Duty of care.

Plaintiffs brought this action to recover damages caused by the backing up of water and sewage from defendant's sewer. The effluents moved through plaintiffs' drains and into the basements of their stores. Defendant excepted to the denial of its motion for a nonsuit. When the judge later declared a mistrial, defendant appealed. The court, finding it to be a question of fact whether defendant's acts constituted negligence, ordered a new trial. Although an essential element of proof in plaintiffs' action involved a showing that the private drain was rightfully connected to the sewer, it was logical to infer from the previous actions of the defendant that the connection of the plaintiffs' drains with the public sewer was rightful. The court noted that the duty owed by a municipality to a person liable to be damaged by the operation of its sewerage system was that of ordinary and prudent care. (Gabrielson-Fla)
W69-06911

ELDER V DELCOUR (NONNAVIGABLE WATERS AND PRIVATE OWNERSHIP).

263 SW 2d 221-228 (Ct App Mo 1953).

Descriptors: *Missouri, *Navigable rivers, *Ownership of beds, *Riparian rights, Public rights, Surface waters, Navigation, Riparian waters, Boundaries (Property), Easements, Nonnavigable waters, Judicial decisions, Fishing, Boats, Transportation, Relative rights, Remedies, Land tenure.

Plaintiff brought this suit to establish his right to fish in a portion of a certain river. The defendant contended that, because the river was nonnavigable, he had a legal right to prevent the public from using the river where it flowed through his property. The court acknowledged that if the waters were navigable, the riparian owner was entitled to have access to and use of the waters for all purposes not inconsistent with the public easement. The court held that in order to constitute a navigable body of water, the river must be susceptible of being used for purposes of trade, travel, and commerce. However, the court found that the river was not capable of supporting any type of commercial navigation; its only useful purpose was for fishing. Consequently, the defendant had a right to restrain the public from using the river on his land. (Stewart-Fla)
W69-06913

BOWES V CITY OF CHICAGO (INTERFERENCE WITH NAVIGATION BY CONSTRUCTION OF FILTRATION PLANT).
3 Ill 2d 175, 120 NE 2d 15-32 (1954).

Descriptors: *Illinois, *Navigable waters, *Riparian rights, *Harbors, Cities, Filtration, Rivers, Boundaries (Property), River beds, Ownership of beds, Riparian waters, Federal government, State governments, Navigation, Contracts, Financing, Taxes, Construction, Judicial decisions, Legal aspects.
Identifiers: Filtration plants, Corps of engineers, Injunctions (Prohibitory), Restrictive covenants.

Appellant city sought to construct a water filtration plant in its harbor on submerged land under navigable water. It received a permit for the construction from the Army after a finding that the proposed construction would not impair navigation. Appellees were of two groups: (1) taxpayers and (2) property owners claiming violation of contract rights. Appellee taxpayers sought to have the construction enjoined on the ground that it impaired navigation. Appellee property owners sought to have it enjoined because the construction would violate certain covenants with appellant. The property owners had deeded their land and riparian rights to appellant upon the condition that the land would never be used for other than park purposes. From an order granting an injunction, appellant appealed. The court reversed holding: (1) that although the state held title to land under navigable waters in trust for the benefit of all interests, the plant would not impair navigation, and (2) that the plant was to

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be built on land other than that covered by the covenants between the parties. (Helwig-Fla)
W69-06914

GREAT LAKES BASIN COMPACT.

Minn Stat Ann sec 1.21 (1967), as amended, (Supp 1968).

Descriptors: *Minnesota, *Great Lakes region, *Interstate commissions, *Interstate compacts, Great Lakes, navigation, Wildlife, Fish, Soil erosion, Soil conservation, Diversion, Water levels, Water resources development, Water policy, St Lawrence River, Fishing, Natural resources, Regulation.
Identifiers: *Great Lakes Basin Compact.

The Great Lakes River Basin Compact has as its purpose the development and conservation of the water resources of the Great Lakes Basin. The Great Lakes Commission, as created under the compact, will exercise jurisdiction over so much of the following as is included within the signatory states: Lakes Erie, Huron, Michigan, Ontario, St Clair, and Superior; the St Lawrence River; and all rivers, ponds, lakes and other watercourses connecting with the St Lawrence. The composition of the Commission is established. The signatory states agree to consider the Commission's recommendations with respect to: lake levels, pollution, navigation, fishing and wildlife resources, soil erosion, and diversion of waters from and into the Basin. Any state may withdraw from the compact after six months notice. (Kahle-Fla)
W69-06915

LEGAL STRUCTURES FOR INTERNATIONAL SUPERVISION OF WEATHER MODIFICATION TECHNIQUES,
Raphael J. Moses, and James N. Corbridge, Jr.
International Conference on Water for Peace, Vol 2, pp 410-420 (1968). 10 p, 21 ref. For 8 volume proceedings see Vol 2, No 9, Field 06B, W69-03305.

Descriptors: *International law, *Public benefits, *Treaties, *Weather modification, Legislation, Adjudication procedure, Weather, Artificial precipitation, Cloud seeding, Conservation, Droughts, Legal aspects, Meteorology, Political aspects, Rain, Water supply, International commissions.

Both social and financial benefits are derived from programs of scientific weather modification. Legal structures must be established on both the national and international level to supervise and administer weather modification programs. To date, litigation is insufficient to reveal the doctrines and concepts which the courts will employ to resolve private weather modification disputes. Conceding the fact that a case by case resolution of disputes under common law principles gives rise to a degree of uncertainty in the law, nevertheless no statutes have been passed which purport to affect the liability of operators vis-a-vis landowners. So far, federal concern has centered about investigating and coordinating weather modification rather than regulating it. Most existing law concerning weather modification has evolved from property rights and remedies for invasion of these rights. These legal structures appear to be inadequate. Since moisture-laden clouds move without regard for state or national boundaries, regulation and reparation cannot be parochial in character; a central administrative agency in each country seems appropriate. Perhaps the national government should underwrite the excess risks of prospective damage claims from large-scale weather modification schemes. The World Meteorological Organization is an existing regulatory authority for outer space, and it would be a simple matter to adapt its organizational structure to the task of regulating weather modification as well. (Scott-Fla)
W69-06916

BURKHARDT V UNITED STATES (CONGRESSIONAL AUTHORITY TO PAY DEBTS NOT OTHERWISE PROVIDED FOR IN LAW).
84 F Supp 553-560 (Ct Cl 1949).

Descriptors: *Compensation, *Dams, *Federal government, *Hydroelectric plants, Judicial decisions, Wisconsin, Condemnation, Eminent domain, Damages, Navigation, Riparian rights, Legislation, Navigable waters, Debt, United States, Water levels, Tailwater, Federal jurisdiction, Dam construction.
Identifiers: *Constitutional law.

The plaintiff brought this suit to recover compensation for the loss of power capacity in its hydroelectric plant. The loss was due to the defendant's construction of a dam for navigational purposes. The effect of the dam was to lower the water level of the river upon which the plaintiff was dependent to generate power. The trial court entered a judgment for the defendant. It held that the government operations to aid navigation often damage or interfere with advantages enjoyed by riparian owners, but the mere fact that damage has occurred confers upon the courts no power to require compensation where there is no taking of property. However, shortly after the trial court rendered its decision, Congress passed an act authorizing the Secretary of the Treasury to pay the plaintiff in full satisfaction of the claim for damages caused by the diminution of generating capacity. Such moral or equitable losses may be compensated by Congressional authority under its constitutional power to provide for the payment of debts. The court acknowledged that Congress has authority to create a new cause of action and upheld the plaintiff's claim. Without the new Congressional legislation, the plaintiff had no cause of action. (Stewart-Fla)
W69-06917

WALKER V FELMONT OIL CORP (OWNERSHIP OF BEDS AND UNDERWATER MINERAL LEASES).

136 F Supp 584-592 (W D Ky 1955).

Descriptors: *Kentucky, *Ownership of beds, *Leases, *Mineral industry, Ohio River, Patents, Judicial decisions, Exploration, Natural resources, Administrative agencies, State governments, Local governments, River beds, Riparian lands, Oil, Natural gas, Exploitation, Land tenure, Remedies, Riparian rights, Beds under water.

The plaintiffs brought this suit seeking a judgment confirming their alleged exclusive rights to oil and gas under the northern half of the Ohio River bed. Three groups held conflicting interests, each claiming the exclusive right to extract oil and gas from the river bed. All the parties conceded the sovereign power of Kentucky to permit the development of oil and gas deposits in the Ohio River bed. They disagreed sharply as to legislative acts advanced as authority. Plaintiffs' claim the rights by virtue of certain land patents purporting to convey to them title to portions of the river bed. However, the court held the patents invalid. The statute authorizing patents contemplated the conveyance of land that could be settled and lived on, not of submerged land. One group of defendants acquired the rights to the oil and gas from a county. This acquisition was also held invalid. The statute authorizing the county to grant leases applied only to sand and gravel deposits. The third defendant based his claim to the minerals on a lease from the state property and Buildings Commission. The court upheld this claim since the legislature had given the commission the power to dispose of state land not needed for public use. The court concluded that the power to sell real property includes the power to execute oil and gas leases. (Stewart-Fla)
W69-06918

DANZIGER V UNITED STATES (EMINENT DOMAIN FOR LEVEE CONSTRUCTION).
93 F Supp 70-72 (ED La 1950).

Descriptors: *Eminent domain, *Federal government, *Levees, *Flood control, Judicial decisions, Louisiana, Engineering structures, Dikes, Construction, Navigable waters, Mississippi River, Flood protection, Public rights, State governments, Easements, Compensation, Appropriation, Repairing, Legal aspects.
Identifiers: Servitudes.

The plaintiffs brought this suit to recover the value of property allegedly taken by the defendant for construction of a levee in Louisiana. The court noted that, under Louisiana law, land located along navigable waters is subject to a servitude in favor of the public for the purpose of constructing and repairing levees. However, state property is appropriated by state levee districts, not by the federal government. The taking is an exercise of the state police power. The court dismissed the action. The defendant federal government had not appropriated the property, and, thus, there was no basis for a cause of action against it. (Stewart-Fla)
W69-06919

PEOPLE V SYSTEM PROPERTIES, INC (OWNERSHIP OF THE BEDS OF NAVIGABLE WATERS).

281 App Div 433, 120 NYS 2d 269-281 (1953).

Descriptors: *New York, *Ownership of beds, *Navigable waters, *Dams, Beds under water, Beds, Navigable rivers, Riparian rights, State governments, Legislation, Judicial decisions, Navigation, Rivers, Lakes, River beds, Nonnavigable waters, Reservoirs, Lake beds, Recreation, Prescriptive rights, Legal aspects.
Identifiers: Navigable in fact, Injunctions (Prohibitory).

The people of the state, joined by several reparian owners, sought a judgment declaring the ownership of the bed of a certain navigable lake and its tributary to be in the state. The riparian owners also sought to enjoin defendant from maintaining a dam on the tributary which caused the water level of the lake to rise. The trial court found that the state had the power to regulate the lake but decided that it was in the best interests of all concerned that maintenance of the dam and regulation of the lake level be placed under court supervision. The appellate court reversed, holding that the trial court had exceeded its power and had invaded the province of the legislature. The court declared that the state owned the bed of the lake and its tributaries and had the right to control the use of the waters. The sovereign powers of the state are exercisable by the legislature alone; riparian owners cannot force exercise by the state of its reserve powers to demand removal of a dam. In addition, assertion by the riparian owners in this case of their riparian right was barred by the running of the prescriptive period. (Helwig-Fla)
W69-06920

PASSAIC VALLEY FLOOD CONTROL COMM'N; FLOOD CONTROL.

N J Stat Ann secs 58:16-1 to 58:16A-4 (1966), as amended, (Supp 1968).

Descriptors: *New Jersey, *Flood control, *Federal government, *Project purposes, Project planning, Cost allocation, Cost repayment, Cost sharing, Federal project policy, Grants, State governments, Cities, Administrative agencies, Legislation appropriation, Financing, Regulation.

The Passaic Valley Flood Control Commission was established to include all the territory of the seven counties in the Passaic Valley. The Commission may apply to and obtain from the federal government approximately twelve million dollars for flood control purposes. The Commission was established after New Jersey decided to participate in a federal program of flood control. The state treasurer is authorized to receive moneys from both the federal government and the counties for reimbursement of

xpenses incurred in connection with any federal ood control project. The state appropriated 275,000 to pay for the state's partlcipation in the roject and for certain other related activities. lowever, none of the appropriated money is to be ade available until the federal government has uthorized at least one project within the state and lloted funds to effectuate it. (Stewart-Fla)
V69-06921

LOOD CONTROL.
N J Stat Ann secs 58:16A-6 to 58:16A-17 (1966), s amended, (Supp 1968).

Descriptors: *New Jersey, *Administrative agenies, *Federal project policy, *Flood control, State overnments, Local governments, Cities, Eminent omain, Easements, Condemnation, Project purposes, Cost allocation, Cost sharing, Public utilies, Grants, Legislation, Conservation, Federal overnment, Project planning, Proprietary powers.

The Commissioner of Conservation shall carry out he relocation and reconstruction of water supply ystems and sewer systems when such is made ecessary by the construction of federal flow conrol projects. Amunicipality may participate in the ood control program after execution of a written tipulation that the municipality will help defray he costs. The costs of requiring a public utility to elocate its facilities shall be considered as part of he cost of the work. The commissioner has the ight to acquire any property necessary to the proect by gift, purchase, or condemnation. If, subequent to the taking of a temporary easement right n property, the commissioner determines that the se of the property for project purposes is no onger necessary, he may surrender the property to he original owner and terminate the easement ights. After completion of flood control projects, nd after such works have been turned over to the tate by the federal government, the project works hall be maintained by the commissioner of conseration. However, the commissioner shall not exerise any of the enumerated powers until such proects have been approved by the legislature. Stewart-Fla)
W69-06922

LOOD HAZARD AREAS.
N J Stat Ann secs 58:16A-50 to 58:16A-54 (1966), s amended, (Supp 1968).

Descriptors: *New Jersey, *Flood protection, *Flood plains, *Administrative agencies, Public ealth, Safety, Flood control, Flood damage, Hazards, Cities, Floodwater, Legislation, Legal spects, Publications, State governments.

n the interest of the health and safety of all New ersey citizens, the Legislature empowers the Divi- ion of Water Supply to delineate and mark flood azard areas and to coordinate the dissemination of nformation on floods after studying the nature and xtent of flood plains. The Council of the Water upply Division shall delineate such flood hazard reas which may constitute a threat to public health nd safety. This information is to be distributed in he prescribed manner and places. The division ay mark in the field any flood hazard area elineated by the council. The division may erect narkers on any state property. Markers may also e placed on any county, municipal, or private proerty if permission is first obtained. (Stewart-Fla)
W69-06923

AERONAUTICS.
Minn Stat Ann sec 360.041 (1966), as amended, (Supp 1968).

Descriptors: *Minnesota, *Airports, *Beds, *Cities, Reclamation, Bridge construction, Public lands, Rivers, Ponds, Lakes, Streams, Water utilization, Legislation, State governments, Political aspects, Legal aspects, Breakwaters.
Identifiers: Causeways.

A municipality's power to establish and maintain airports includes the power to establish and maintain such airports in, over, and upon any public waters and submerged or reclaimed land within the state. In addition, municipalities possess the power to construct terminal buildings, landing floats, causeways, bridges, and breakwaters for approaches to, or for the protection of, such airports. (Kahle-Fla)
W69-06924

REGIONAL SANITARY SEWER DISTRICT LAW.

Minn Stat Ann secs 115.61 to 115.67 (1964), as amended, (Supp 1969).

Descriptors: *Minnesota, *Sewage districts, *Cities, *Water pollution control, Industrial wastes, Financing, Local governments, Legislation, Legal aspects, Land tenure, Administrative agencies, Supervisory control (Power), Taxes, Condemnation, Sewage, Sewage treatment, Treatment facilities, Regulation.
Identifiers: *Police power.

A sanitary sewer district shall be a municipal corporation responsible for acquiring and maintaining facilities for treatment of sewage and industrial wastes to prevent water pollution. It may sue and be sued, acquire property, be exempt from taxation, and exercise all powers granted municipalities in Minnesota. All powers shall be exercised under authority of the board of directors, which shall be exercised according to the rules of this section. The chief executive officer shall be chosen by the board and hold office on the same basis as a village manager under secs. 412.641-.751, except all appointees shall be subject to board approval. The acquisition of property by a district shall not be restricted or controlled by other local government, except under the police power. Any municipality may request annexation of its territory to a district, subject to board and Water Pollution Control Commission approval. All annexed territory shall be subject to taxation by the district. The provisions of this act are severable. (Harris-Fla)
W69-06925

WATER POLLUTION CONTROL.

Minn Stat Ann secs 115.17 (6), 115.19, 115.26 to 115.30 (1964), as amended (Supp 1968).

Descriptors: *Minnesota, *Water pollution, *Water resources development, *Administrative agencies, Public health, Legislation, Conservation, Project purposes, Public utilities, Resource development, Treatment facilities, Sewage treatment, Local governments, Septic tanks, Sewage disposal, Natural resources, Water pollution control.

The duties of the water pollution control advisory committee are to assist the Pollution Control Commission and to help formulate a statewide comprehensive policy for the conservation and development of water resources and the prevention of pollution. A sanitary district may be created to promote public health and welfare by providing an efficient sewage and disposal system. Each state congressional district may construct, improve, and maintain a system for pollution prevention and control. The district may require any person to use the disposal system. The district may regulate the construction and use of all sanitary facilities in order to protect public health. It may prohibit the use of facilities not connected with the district disposal system. A district may enter any joint project for the purpose of constructing, improving, and maintaining any system or facilities. (Stewart-Fla)
W69-06926

STATE LANDS; SALES, INVESTMENT OF PROCEEDS.
Minn Stat Ann secs 92.01, 92.04, 92.12, 92.45, 92.50 to 92.59 (1964) as amended (Supp 1968).

Descriptors: *Minnesota, *Mississippi River, *Lakes shores, *Land management, Drainage practices, Legislation, Federal government, Federal-state water rights conflicts, Lakes, Land use, Public lands, Rivers, Water policy, Legal aspects.

'State lands' or 'state public lands' are lands granted to the state by act of Congress. Minimum prices for the sale of such lands are established. Valuation of land and improvements shall be made, when necessary, by appointed state appraisers who shall also report which lands, in their opinion, should be drained. Notice requirements and provisions for separate sales of timber are set out. State lands bordering on meandered lakes or other public waters are withdrawn from sale except as they may be required by the federal government in connection with projects for the improvement of navigation on the Mississippi River. Leasing of mineral rights on unsold land is also provided for. (Kahle-Fla)
W69-06927

TOWNS, SPECIAL PROVISIONS.
Minn Stat Ann secs 368.50, 368.56 to 368.58, 368.78 (1966), as amended, (Supp 1968).

Descriptors: *Minnesota, *Water conservation, *Zoning, *Sewers, Sewage disposal, Water works, Legislation, State governments, Municipal water, Property values, Population, Reservoirs, Construction, Cities, Local governments.

Towns with populations in excess of 3000 and with assessed property values in excess of $10,000,000 may erect and maintain waterworks and sewage disposal plants. Towns with population in excess of 450,000 and assessed property value in excess of 280,000,000 or towns within 10 miles of a city of the first class may adopt zoning resolutions affecting water supply conservation upon the approval of 50 percent of those voting at a town meeting. The resolutions shall become effective 10 days after adoption unless 50 percent of the property owners within the affected area file written objection with the town clerk. Two thirds of the property owners in the affected area must approve any modification in the adopted resolution. Town boards are authorized to construct and maintain sewers for drainage purposes and to acquire land to provide for a reservoir. (Kahle-Fla)
W69-06928

NAMING LAKES, RIVERS, STREAMS, AND BODIES OF WATER.
Minn Stat Ann secs 378.01 to 378.06 (1968), as amended, (Supp 1969).

Descriptors: *Minnesota, *Lakes, *Rivers, *Local governments, Ponds, Legislation, State governments, Regulation, Administrative agencies, Legal aspects.
Identifiers: *Naming of water bodies.

The county board may be petitioned by any 15 voters of the county or the state Geographic Board to name, or to change the name, of any lake, river, stream or body of water within the county. Notice of hearing must be served on certain public officials. All interested parties may appear at the hearing which shall be held by the county board wherein the name of the body of water shall be determined. Before any action may be taken on a petition, bond must be posted by the petitioners to cover all reasonable expense to the county. Names of existing bodies of water are not to be duplicated. (Kahle-Fla)
W69-06929

GUARDING ICE-CUTTING.

Minn Stat Ann sec 378.21 (1968), as amended (Supp 1969).

Descriptors: *Minnesota, *Ice, *Hazards, *Regulation, State governments, Public rights, Public benefits, Relative rights, Legislation, Legal aspects.

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Identifiers: Penalties (Criminal).

Every person cutting ice upon waters within the state must surround the openings with fences or guards until the ice has formed to a thickness of at least 6 inches. Failure to comply renders the violator guilty of a misdemeanor. (Kahle-Fla)
W69-06930

INCORPORATION, CITIES FOURTH CLASS.

Minn Stat Ann secs 411.01, 411.40 (1958), as amended, (Supp 1968).

Descriptors: *Minnesota, *Drainage, *Cities, *City planning, Local governments, Cesspools, Legislation, Municipal water, Landfills, Navigable waters, Boundaries (Surfaces), Bridges, Harbors, Levees, Tunnels, Water pollution control, Regulation, Sewers.

Villages with not less than 1000 nor more than 10,000 inhabitants may incorporate as a city of the fourth class. The council of such a city shall have the following powers and duties: to regulate the use of bridges, viaducts, tunnels, drains, sewers, and cesspools; to compel railways to keep open ditches and drains along their tracks; to restrain pollution of any waters within or adjacent to the city; to compel the owner of low ground where water is liable to collect and become stagnant to fill or drain such low places; to regulate and supervise navigable waters; to make regulations in regard to the use of vessels and opening of bridges; to appoint harbor masters and define their duties; and to prevent the removal of sand or other material from levees, embankments or boundary lines of public waters. (Kahle-Fla)
W69-06931

VILLAGE POWERS.
Minn Stat Ann secs 412.221, 412.491, 412.521 (1958), as amended, (Supp 1968).

Descriptors: *Legislation, *Local governments, *Recreation facilities, *City planning, Community development, Cities, Planning, Parks, Sewage systems, Public benefits, Health, Project planning, State governments, Navigable waters, Minnesota, Harbors, Piers, Construction, Maintenance, Regulation.

The village council shall have power to construct, alter and maintain streets, sidewalks, parks, squares, and other public grounds. The council is also empowered to regulate the water supply, waterworks, sewer system and to control the location, construction, and use of piers, docks, and wharves. The council is authorized to acquire and operate ferries across any river in the village. The council has the power to define nuisances and to provide for the prevention or abatement thereof. To effectuate the powers relating to parks and recreational facilities, the park board may employ the necessary personnel. In addition, it may construct paths, roads, buildings, and any related recreational facilities. The board may, with consent of village council, make contracts and leases for construction and operation of these facilities. Finally, the park board may provide music and free entertainment for the general public. (Stewart-Fla)
W69-06932

MUNICIPAL POWERS.
Minn Stat Ann secs 429.011, 429.021, 435.46, 435.47 (1947), as amended (Supp 1968).

Descriptors: *Minnesota, *Local governments, *Cities, *Construction, Water works, Public utilities, Maintenance, Legislation, Public benefits, Storm drains, Cities, Flood control, Water supply, Leases, Contracts, Conduits.

The term municipality is defined for purposes of this act. The council of a municipality has the power to acquire, widen, and improve any street and may construct and maintain sidewalks, curbs, and parking strips. The council is authorized to construct, extend, and maintain storm, sewer and waterworks systems and related facilities. The council may abate nuisances and drain swamps or marshes on public or private property. The council of any fourth class city may contract or enter into agreements with any adjoining municipality having a water system, in order to furnish water to its citizens. The adjoining municipality will be allowed to lay the water mains under the direction of the council. The council of any village adjacent to a first class city is authorized to purchase water from the city for re-sale to the village inhabitants provided such village has a water and sewer main connecting to the city system. (Stewart-Fla)
W69-06933

RIGHTS, POWERS, DUTIES, MUNICIPALITIES.
For primary bibliographic entry see Field 06C.
W69-06935

PLATS; COORDINATES; SURVEYS.
Minn Stat Ann sec 505.02 (1947), as amended (Supp 1968).

Descriptors: *Minnesota, *Boundaries (Property), *Boundaries (Surfaces), *Maps, Lakes, Ponds, Rivers, Streams, Legislation, Water levels, Drainage, Public utilities, Easements, Benchmarks, High water mark, Low water mark.
Identifiers: *Plats.

Regulations for setting out boundaries on plats are enacted. Where water bodies constitute a boundary, a survey line with angles and distances between all angle points and their relation to a water line is to be shown. All water bodies must be correctly located and plainly designated on the plat. Any plat including lands abutting upon a lake or stream shall show a contour line of the present shore line, water elevation, and date of survey. The highest known water level shall be indicated. Only those easements relating to public utilities and drainage need be platted. (Kahle-Fla)
W69-06936

BOATS, VESSELS; ACTIONS AGAINST.

Minn Stat Ann secs 579.01 to 579.08, 624.69 (1964), as amended (Supp 1968).

Descriptors: *Minnesota, *Boats, *Ships, *Adjudication procedure, Damages, Legislation, Judicial decisions, Navigable waters, State governments, State jurisdiction, Navigation, Legal aspects.
Identifiers: *Judgment liens, Security bonds, Execution sales.

Vessels used in navigable waters of the state are made liable for the following claims which constitute liens: (1) debts contracted by the owner or master for supplies, services, or repairs; (2) wharfage and anchorage fees; (3) damage claims resulting from the non-performance of contracts; (4) injuries to persons or property by the vessel. Provisions for the seizure and execution sale of the vessel are set forth. Upon the delivery of bond to the plaintiff in an amount adequate to cover alleged damages, the vessel may be released prior to judgment where there is court approval. The master or owner may be personally bound if the judgment remains unpaid for over 60 days. Appeals from an adverse judgment may be taken as in other cases. Actions under this chapter must be brought within one year. (Kahle-Fla)
W69-06937

PUBLIC USES FOR WHICH PRIVATE PROPERTY MAY BE TAKEN OR DAMAGED.

W Va Code Ann secs 54-1-2, 54-1-3a, 54-1-9, 54-1-10 (1966).

Descriptors: *West Virginia, *Eminent domain, *Canals, *Water supply, Natural resources, Pipelines, Reservoirs, Reservoir storage, Water conveyance, Water storage, Water resources development, Condemnation, Legal aspects, Sewers, Dams, Railroads, Industrial water, Proprietary power, Easements, Real property, Legislation, Impounded waters, Land tenure, Public benefits, Conveyance structures, Pumping.

Private property may be taken or damaged for the construction, maintenance, and operation of canals and water plants for public use. The right of eminent domain in regard to water plant facilities extends to the appropriation of property for sites for pumping stations, reservoirs, cisterns, storage dams and conveyance structures. Lands which may be flooded by the impounded waters are subject to condemnation. Any spring or stream may be taken for public use. The right of eminent domain extends to property required for construction, maintenance, and operation of sewer systems and related facilities. Any railroad company may impound and consume any and all water located on lands adjacent to its road, provided such water is not required by the owner of such property. (Katz-Fla)
W69-06938

INTERSTATE SANITATION COMMISSION.
Conn Gen Stat Ann sec 25-55 to 25-66 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *Interstate compacts, *Interstate comm'ns, *Water resources development, Interstate rivers, Coasts, Continental margin, Streams, Public health, Public benefits, Tidal waters, Pollution abatement, Legislation, Water pollution control, Sewers, Waste disposal, Sewage sludge, Bacteria, E coli, Classification, Legal aspects, State governments, Administrative agencies, New York, New Jersey, Shellfish.

The states of Connecticut, New Jersey, and New York have entered into a tri-state compact to abate increasingly serious pollution of harbors and coastal and tidal waters. The compact provides for the creation of an Interstate Sanitation Commission comprized of five Commissioners from each state. The Commission is charged with administering pollution regulations set forth in the compact within the Interstate Sanitation District. This District consists of the major coastal, estuarial and tidal waters within the signatory states. These waters are to be classified by the Commission into two divisions. Class 'A' waters are to be used for recreational purposes, shellfish culture, or development of fish life. Sewage discharged into these waters must be kept free from all floating solids and free from 60% of all suspended solids. All other waters are to be considered Class 'B' waters, and sewage discharged into these waters is required to be free from all floating solids and free from 10% of suspended solids. The commission may bring a court action in any of the several states to enforce the provisions of this compact. (Katz-Fla)
W69-06939

FLOOD CONTROL AND BEACH EROSION: STATE ASSISTANCE.
Conn Gen Stat Ann secs 25-69 to 25-71, 25-74 (1958).

Descriptors: *Connecticut, *Floods, *Shore protection, *Flood control, Storms, Beaches, Beach erosion, High water mark, Low water mark, Ownership of beds, Dams, Tidal waters, Flood Plains, Flood walls, Flood protection, Legal aspects, Legislation, Watercourses (Legal), Tidal effects, Construction costs, Shore-line cover, Project purposes, Project benefits, Public benefits, Land tenure, State governments, Water resources development.

The state has undertaken the task of constructing protective works on or near shores and beaches within areas susceptible to damage from severe

torms accompanied by high winds, abnormally igh tides and tide flooding. State protection of the xposed areas is within the public interest since the ndividual landowners would be unable to maintain omparable works without cooperation from butting landowners, and since title to lands etween high and low water marks is vested in the tate. Encroachment limits are to be provided long waterways, and flood control features at ams and reservoirs are to be utilized as part of any lood control projects. Lands fronting on the cean, bays, inlets, coves, or rivers in which tides ccur; lands exposed to erosion through wave ac- ion; and open beach areas or lands subject to inun- ation because of their geographical situation are efined as exposed areas. The exposed areas are elimited by natural configuration, not political oundaries. The water resources commission is uthorized to pay stated percentages for work done ith local governments and private citizens, and to rrange for use of available federal and municipal acilities. (Kelly-Fla)
V69-06940

LOOD CONTROL AND BEACH EROSION STATE ASSISTANCE).
Conn Gen Stat Ann secs 25-76 to 27-83 (1958), as mended, (Supp 1968).

Descriptors: *Connecticut, *Water injury, *Shore rotection, *Storms, Federal government, Legisla- on, Legal aspects, Flood control, Flood protec- on, Flood plains, beaches, Beach erosion, Dis- sters, Tidal waters, Tidal effects, Barriers, Floods, ssessments, Cities, Flood damage, Reimbursable osts, Project benefits, State governments, Right of ay, Easements, Operation and maintenance.

he water resources commission is authorized to ooperate with the federal government and any unicipality in the construction of small flood con- ol systems for tidal and hurricane protection, and avigation projects including dams, dikes, flood alls, reservoir, river channel improvements and ther works necessary to reduce or prevent flood amage. The commission may require reimburse- ent by affected municipalities. The commission, n making any assessment, should consider: (a) the xtent and character of the area affected by the roposed project; (b) the economic effect of pro- ective measures in preventing loss of life, property, nd revenue; and (c) the benefit conferred upon ontiguous or downstream municipalities by reason f the projects. The commission may give as- urance to the federal government that the state ill provide lands, easements, and necessary rights f way, without cost, for flood control projects and ill maintain and operate the works after comple- on. The commission may require relocation of ny public service company in order to secure nds or rights of way for such projects. (Kelly-Fla)
V69-06941

CONOMIC EVALUATION OF A WATER ESOURCES DEVELOPMENT PROJECT IN A EVELOPING NATION,
alifornia Univ., Berkeley. Hydraulic Engineering ab.
or primary bibliographic entry see Field 06B.
V69-06981

IDD MFG CO V TOWN OF BLOOMFIELD, SSEX COUNTY (EROSION OF STREAMBED HROUGH ACCELERATED FLOW).

8 N J Super 355, 100 A 2d 708-713 (1953).

Descriptors: *New Jersey, *Alteration of flow, Bank erosion, *Stream erosion, Riparian rights, treambeds, Streams, Local governments, Dams, Damages, Remedies, Judicial decisions, Augmenta- on of flow, Legal aspects, Cities, Banks, Erosion.
Identifiers: *Contributory negligence.

Plaintiff alleged that improvements made by defen- ants caused the flow of the stream bordering plaintiff's property to accelerate. This accelerated flow eroded the stream bed and undermined the banks of the stream adjacent to plaintiff's property, damaging a building. Plaintiff sued to recover for this damage. The court rejected defendants' argument that, since plaintiff's injuries were incidental to acts done under legislative authority, the injuries sustained were damnum absque injuria. The court also found that defendant's actions constituted misfeasance, not nonfeasance, in that it was an active wrongdoing. However, the court held that plaintiff's negligent removal of 30 or 40 tons of stone from the stream bed was a concurrent cause of the cutting away of the stream bed and of the results which followed. Therefore, plaintiff's contributory negligence barred recovery. (Gabrielson-Fla)
W69-07015

GULF REFINING CO V DAVIS (SEEPAGE FROM A SALT WATER PIT).

80 So 2d 467-470 (Miss 1955).

Descriptors: *Water storage, *Seepage, *Mississippi, *Damages, Leakage, Reservoir leakage, Saline water, Overflow, Reservoir storage, Judicial decisions, Remedies, Pit recharge, Real property, Legal aspects, Oil wells, Encroachment, Relative rights, Leases.

Plaintiff sued defendant corporation, an oil and gas lessee, for damages to his land and timber resulting from seepage and overflow from a salt water pit and from the construction of a larger pit on plaintiff's land. Following a jury verdict for plaintiff, defendant appealed. The court held that the lessee was liable for any damages caused by his wrongful acts. Whether the seepage or overflow of salt water onto plaintiff's land was the result of defendant's negligence was a question of fact for jury. However, since the court considered the jury verdict to be excessive, the case was reversed and remanded for a new trial. (Gabrielson-Fla)
W69-07016

MAGNOLIA PETROLEUM CO V WILLIAMS (PROOF OF WATER WELL CONTAMINATION FROM SALT WATER DISPOSAL PIT).
76 So 2d 365-368 (Miss 1954).

Descriptors: *Mississippi, *Saline water intrusion, *Oil wells, *Water pollution, Water wells, Land tenure, Damages, Seepage, Relative rights, Oil industry, Judicial decisions, Salinity, Waste disposal, Disposal, Water quality, Water pollution sources, Water injury.
Identifiers: *Proximate cause, *Disposal pits.

Plaintiff brought this suit for damages caused to his water well by brine water intrusion. Plaintiff maintained a water well for human and animal consumption. Defendant maintained two oil wells nearby. The oil wells produced twelve barrels of salt water each day which were emptied into a disposal pit. Other salt water disposal pits were near plaintiff's well. Defendant had no control over these other wells. Any salt water contamination would have been due to the underground movement of leakage from the disposal pits. In the trial court, plaintiff recovered $1,250. Defendant appealed on the ground that proximate cause was not shown. The Supreme Court held no recovery was possible where several causes of injury were possible and some could not be attributed to the defendant. Any judgment rendered would be based on mere conjecture since the evidence was not conclusive in showing that defendant's pit contaminated the well. (Harris-Fla)
W69-07017

HOLLIDAY V CITY OF GREENVILLE (ALTERATION OF NATURAL DRAINAGE CONDITIONS).
For primary bibliographic entry see Field 04A.
W69-07018

CARVER V TANNER (DISCHARGE OF SALT WATER INTO STREAM).

312 Ky 388, 227 SW 2d 905-906 (1950).

Descriptors: *Kentucky, *Oil wastes, *Saline water, *Discharge (Water), Mine wastes, Mine water, Flow augmentation, Judicial decisions, Water law, Legal aspects, Streamflow, Alteration of flow, Damages, Relative rights, Water pollution sources, Streams, Oil wells.
Identifiers: *Injunctions (Prohibitory).

Plaintiff brought action to enjoin defendant from discharging salt water into a stream which passed through plaintiff's land. Defendant was an oil producer, and the discharge of the salt water wastes was a necessary operation in his business. The court denied the injunction but awarded nominal damages to the plaintiff. The discharge by defendant at most increased the flow of the stream and caused plaintiff no material damage. When one party would be materially harmed by an injunction and the other party was not suffering material or substantial damage, the court will refrain from issuing the injunction. (Holt-Fla)
W69-07019

MCCABE V CITY OF PARKERSBURG (DUTY OF CITY TO MAINTAIN SEWERS SO AS NOT TO UNDERMINE LAND).

79 SE 2d 87-96 (W Va 1953).

Descriptors: *West Virginia, *Sewage, *Cities, *Land subsidence, Relative rights, Land tenure, Alteration of flow, Leakage, Damages, Storm drains, Judicial decisions, Legal aspects, Land, Soil erosion, Underseepage, Underground storage, Buildings, Maintenance.
Identifiers: *Lateral support, Negligence, Absolute liability.

Plaintiff sought damages in trespass for the undermining and sloughing away of her lot and settling of her dwelling. The damages were allegedly caused by defendant city's collection of water in its sewer system and by the wrongful casting of such water upon plaintiff's and adjacent land. Evidence showed a breakage of defendant's underground storm sewer which caused the damage. A circuit court jury returned a verdict for plaintiff. The Supreme Court of Appeals held that an owner of land was entitled to lateral support in adjacent land of his soil, but not for his buildings erected thereon. Any recovery for building damage must be based on negligence. The court further held the city had a duty of care in maintaining its sewage system, but not an absolute duty not to damage. The court ruled these distinctions were not adequately expressed in the instruction to the jury, and, therefore, the verdict included damages which were not recoverable. (Harris-Fla)
W69-07020

LAIRD, ROCK AND SMALL, INC V HARRY T CAMPBELL AND SONS (FLOODING DUE TO NEGLIGENT ROAD CONSTRUCTION).

92 A 2d 380-384 (Md 1952).

Descriptors: *Maryland, *Flooding, *Road construction, *Storm runoff, Ditches, Gullies, Rain water, Storms, Drainage, Storm drains, Dams, Diversion, Flood damage, Flash floods, Damages, Legal aspects, Judicial decisions, Drains, Excessive precipitation.
Identifiers: Contributory negligence.

Plaintiff sued the defendant for damages caused by defendant's negligence in constructing a road next to plaintiff's house. The road was constructed in such a manner that during a heavy rainstorm plaintiff's property was flooded and a wall of his house collapsed. The plaintiff contended that defendant was negligent in removing the topsoil of the road without providing any storm drainage and in cutting the gutter on the side of the road without

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providing any substitute for it. By removing these drainage devices, the flow of water onto plaintiff's land was greatly increased and the damage resulted. The court rejected the defendant's claim that plaintiff was contributorily negligent, noting that a property owner has no duty to make the wall of his house strong as a dam. The court said that if flooding is caused by the negligence of a contractor in grading a road, it was not the abutting property owner's obligation to take precautions against such negligence. The court held that although the extent of the damages caused purely by defendant's negligence could not be separated from the damages caused by the severe rain, the defendant did contribute to the damages and should be held liable for them. (Shevin-Fla)
W69-07021

VENTURA V CITY OF PITTSBURGH (ACCIDENT CAUSED BY ICE FORMING ON A HIGHWAY).

159 Pa Super 279, 47 A 2d 668-671 (1946).

Descriptors: *Pennsylvania, *Highways, *Ice, *Frozen ground, Drainage, Highway icing, Snow, Slush, Storms, Streams, Surface drainage, Legal aspects, Judicial decisions, Sewers, Storm drains, Grassed waterways, Damages, Accidents, Obstruction to flow, Safety, Watersheds (Divides).
Identifiers: Automobiles.

Plaintiff sued defendant city for damages resulting from an accident caused when his automobile skidded on ice on the city's streets. The highway center line was the dividing line between the city and a borough. The court said it was the city's duty to keep its half of the road free from obstructions and in a reasonably safe condition for travel. Abutting the road was a steep hill which formed a natural watershed; surface drainage flowed down the slopes in two defined watercourses. Due to the inadequacy of a storm sewer, water was not carried from the curb to the watershed. Ice formed on both sides of the highway during the winter months. The court held that the duty rests with a municipality to provide for the drainage of water which otherwise would discharge on a highway, and that, although the borough was negligent, the city was liable for its passive negligence. The court further held that it was the province of the jury to decide if ice had formed on both sides of the road. The verdict for the plaintiff was affirmed. (Shevin-Fla)
W69-07022

COSTANZO V STATE (CONTROL OF SURFACE WATERS AND THE NATURAL FLOW DOCTRINE).
For primary bibliographic entry see Field 04A.
W69-07023

MORROW V HARRISON COUNTY (SUIT TO ENJOIN CONSTRUCTION OF A DRAINAGE DITCH).

64 NW 2d 52-61 (Iowa 1954).

Descriptors: *Iowa, *Drainage, *Ditches, *Drainage effects, Land reclamation, Drainage engineering, Channels, Drainage districts, Outlets, Sewers, Surface waters, Rivers, Streams, Silts, Construction, Storm drains, Overflow, Roads, Rainfall, Levees, Legislation, Missouri River, Legal aspects, Judicial decisions, Flow augmentation, Excessive precipitation, Remedies, Discharge (Water), Repairing.
Identifiers: Injunctions (Prohibitory).

Plaintiffs sought to enjoin construction of an open drainage ditch by the defendants. They contended that the new ditch would divert water from a river and cause an overflow which would damage their land. The defendants had determined that the ditch was necessary to drain water which had accumulated in the area due to heavy rainfall. The court held that the plaintiffs failed to prove that substantial injury would result if injunctive relief were denied. It noted that a party is not entitled to relief merely because water is sent over a more direct course to the same destination it formerly reached. It was defendants' duty to properly maintain the ditch, and it is assumed that this duty will be performed. The defendant was authorized by statute to construct the ditch, and the statute is to be liberally construed to promote reclamation of wet and overflow lands. Defendant's use of a natural stream was properly considered a repair to a drainage system. No increased volume of water will be cast upon the plaintiffs' lands. The plaintiffs were not entitled to an injunction. (Shevin-Fla)
W69-07024

ATKINSON V UNITED STATES (FEDERAL LIABILITY FOR DAM BACKWATER).

68 F Supp 99-103 (D Minn 1946).

Descriptors: *Minnesota, *Remedies, *Federal government, *Backwater, Riparian rights, Damages, Legislation, Eminent domain, Dams, Overflow, Rivers, Mississippi River, Streams, Navigable waters, Judicial decisions, Legal aspects, Flood damage, United States, High water mark, Compensation.
Identifiers: Tucker Act.

Petitioners brought claims for damages under the Tucker Act, alleging that the building of Dam No 8 on the Mississippi River and the erection of a dam on Pine Creek caused water to back-up and rise above its normal levels thus damaging plaintiffs' lands. The court determined that the claims for damages were barred by the statute of limitations. It is well settled that the government is not required to make any compensation for damage to lands by reason of the raising of a navigable river up to the ordinary high water mark. Occasional damage caused by heavy rains cannot form the basis for an action against the Government if the river, in its normal state, does not rise above the ordinary high water mark. Actions brought under the Tucker Act must be brought within six years from the date of the alleged taking. Since any taking of land would have had to occur when the waters were raised to their normal level, and since this event occurred over six years before this action was brought, no relief was available. (Gabrielson-Fla)
W69-07025

SEA HARBOR CORP V G AND M DREDGING CO (DAMAGES FROM DREDGING).

105 NYS 2d 497-499 (Sup Ct 1951).

Descriptors: *New York, *Dredging, *Damages, *Compensation, Channel improvement, Islands, Navigable waters, Streams, Federal government, Administrative agencies, Judicial decisions, Legal aspects.
Identifiers: *Injunctions (Prohibitory).

Plaintiff brought action for damages and injunctive relief against defendant holding company (holder of a government permit authorizing dredging operations). Plaintiff was the owner of an island, part of which had fallen into a creek due to negligent dredging operations by defendant. The court denied plaintiff the immediate injunction since defendant had ceased all dredging activity pending this suit. The court also denied a permanent injunction since the work was being done pursuant to a War Department permit. The court did award damages to the plaintiff since, even if the federal government ordered the dredging, and assuming an absence of negligence, nevertheless, under the 5th amendment of the Federal Constitution, just compensation would have to be paid. Here there was no question that defendant's dredging operations were negligently performed. Thus, there was no doubt that damages should be awarded to plaintiff. (Logan-Fla)
W69-07026

HURD V STATE (NEGLIGENT DISCHARGE OI CANAL WATER).
For primary bibliographic entry see Field 04A.
W69-07027

PURDY V CITY OF NEWBURGH (REGULATION OF RIPARIAN RIGHTS WITH RESPECT TO WATER SUPPLY).

113 NYS 2d 376-382 (Sup Ct 1952).

Descriptors: *New York, *Riparian rights, *Wate supply, *Municipal water, Water quality, Wate quality control, Pollutants, Water pollution con trol, Easements, Condemnation, Legislation Public benefits, Recreation, Lakes, Ponds Streams, Local governments, Judicial decisions Legal aspects, Relative rights, Regulation.
Identifiers: Declaratory judgments.

Plaintiffs brought action against the city for declaratory judgment regarding the parties' lega rights with reference to the application of Healt Department rules and regulations to plaintiffs riparian land. Plaintiffs' land was situated on natural stream flowing between a lake and a pond both of these bodies of water were sources of th city's water supply. The regulations in questio prohibit pollution of the stream as well as bathin or fishing in it. Plaintiffs, in a prior action, obtaine an injunction against the city preventing violatio of any riparian rights. Plaintiffs now contend tha the city must institute condemnation proceeding and obtain an easement to enforce the regulations they contend that a failure to do so will constitut an abandonment of the regulations since the rule and the possibility of condemnation constitute cloud on plaintiffs' title which has caused depreciation in property value. The court dismisse the action, holding: (1) there was no controversy between the parties; (2) the legislature must deter mine when the rules are to be abandoned; and (3 the court had power only to order payment for pro perty already taken, not order property to be taken (Kahle-Fla)
W69-07028

L A DARLING CO V WATER RESOURCES COMM'N (ADMINISTRATIVE REGULATIO OF POLLUTION).

341 Mich 654, 67 NW 2d 890-897 (1955).

Descriptors: *Michigan, *Pollution abatement *Adjudication procedure, *Groundwater Lagoons, Chromium, Industrial wastes, Water law Legal aspects, Judicial decisions, Administrativ decisions, Jurisdiction, Administrative agencies Public health, Water quality control, Water pollu tion sources, Water pollution control, Regulation.
Identifiers: Constitutional law, Due proces (Procedural).

Appellant discharged wastes from its electroplatin process into 2 infiltration lagoons provided by th City of Bronson. Appellee, following a conferenc with appellant in which witnesses were not sworn examined, or cross-examined, issued an orde directing appellant to install a suitable wast disposal system which would render its discharge noninjurious to public health. Appellee based it decision on the findings of its sanitary engineer wh indicated that the city's groundwater source was i danger of becoming polluted due to the conditio of the lagoons. Appellant had questioned appellee' jurisdiction over groundwater, but the court foun that the statute creating the commission also gave i jurisdiction over pollution of groundwater. Th court held the order of the commission invalid however, since the hearing afforded appellant ha violated the due process clauses of the Federal an State Constitutions. The commission could onl require the abatement of groundwater pollutio after the defendant had been given a hearing a required by law, in which he would have the oppor tunity to examine and cross-examine witnesses (Holt-Fla)
W69-07029

PETITION OF DREOSCH (PIPELINE EASEMENTS).

47 NW 2d 106-112 (Minn 1951).

Descriptors: *Minnesota, *Eminent domain, *Easements, *Pipelines, *Drainage, Ditches, Remedies, Judicial decisions, Legal aspects, Water law, Construction costs, Drainage district, Compensation, Damages, Easements, Right of way, Relative rights.

Respondent had established a county ditch to provide drainage for over 10,000 acres. Appellant owned a pipeline which would intersect with the drainage ditch in three places. Rights of way for the pipeline had been purchased from private property owners before construction was begun. In order to construct the ditch, appellant's pipeline would have to be lowered or raised at the three points of intersection. Since such action would involve substantial expense, appellant sought to recover damages in an eminent domain proceeding. Damages were awarded to appellant. The court held that an easement or right of way was 'property' within the meaning of the Minnesota constitutional provision prohibiting the taking of private property for a public use without just compensation. To force the appellant to incur the expense of raising or lowering the pipeline in order to facilitate construction of the drainage canal was tantamount to a taking of private property for a public purpose. Because Minnesota had a statute which provided for damages resulting from eminent domain proceedings, the principle of damnum absque injuria was inapplicable. (Holt-Fla)
W69-07030

NEWPORT HOMEWATER CO V PENNSYLVANIA PUBLIC UTILITY COMM'N PURCHASE OF PRIVATE WATERWORKS BY MUNICIPALITY).

174 Pa Super 522, 102 A 2d 221-227 (1954).

Descriptors: *Pennsylvania, *Public utilities, Water works, *Administrative agencies, Cost analysis, Water distribution (Applied), Cities, State governments, Water management (Applied), Legislation, Permits, Water rights, Economics, Legal aspects, Judicial decisions.

The Borough of Newport applied to the defendant Commission for a certificate of public convenience to enable it to purchase plaintiff water company. The plaintiff contended that the price that the defendant would be required to pay was in excess of the available assets and borrowing capacity of the borough. After a careful examination of the financial structure of the Borough, the Public Utilities Commission granted the certificate, holding that the Borough's borrowing capacity was sufficient to meet the purchase price under its construction of the statutory price formula. Acknowledging that it was within the province of the Commission to make such a determination, the court affirmed the order granting the certificate of public convenience. (Stewart-Fla)
W69-07031

RUTLEDGE V UNION ELECTRIC CO OF MISSOURI (RIGHT TO FLOOD CONFERRED BY DEED).

380 SW 2d 670-74 (Mo 1955) (per curiam).

Descriptors: *Missouri, *Easements, *Dams, Flooding, Flood damage, Flood water, Judicial decisions, Legal aspects, Damages, Backwater, Dam design, Reservoirs, Water levels, Water rights, Lakes, Power plants.
Identifiers: Deeds.

Landowners brought action against a power company for damages to land and personal property by reason of intentional flooding of land behind a dam. The power company defended on the ground that it possessed an easement to flood the land in question. The trial judge set aside a verdict and judgment for the landowners and entered a judgment for the power company. The Supreme Court of Missouri affirmed the decision of the trial judge on the ground that unlimited right to flood the land was granted in defendant's deed. A provision in an easement accompanying the deed which stated that the dam would be designed so as to hold the water level at approximately 660 feet above the mean sea level referred to the normal lake level and not to maximum level. Therefore, this provision in no way limited the right to flood granted elsewhere in the deed. (Watson-Fla)
W69-07032

HURLEY V AM ENKA CORP (REASONABLE RIPARIAN USE CONCERNING DAMS).

93 F Supp 98-103 (E D Tenn 1950).

Descriptors: *Tennessee, *Dams, *River regulation, *Competing uses, Reasonable use, Services, Ditches, Water pollution, Legal aspects, Judicial decisions, Flood control, Water control, Boundaries (Property), Riparian rights, Public benefits, Hydraulic structures, Industrial plants, Access routes.
Identifiers: Nolichucky River.

Plaintiff owned a tract of land which was divided by a shallow slough of water during part of each year. The depth of this water varied, but testimony indicated that the water was generally a few inches deep. Occasionally the slough was completely dry. The defendant constructed a dam downstream from plaintiff's land causing the water level in the river and slough to rise, inhibiting plaintiff's access to the 'island' half of his property. Defendant contended that the laws of Tennessee limited the title of a riparian owner along a navigable stream to the land above the low water mark. Consequently, defendant contended that the plaintiff had no interest in the isolated portion of his tract as it was below the low water mark. The court determined that the slough was not the low water mark of the stream and held that the plaintiff's tract had been damaged. Damages were awarded accordingly. (Katz-Fla)
W69-07033

DELAWARE RIVER ABOVE AND BELOW TRENTON FALLS WITHIN JURISDICTION OF NEW JERSEY AND PENNSYLVANIA.

N J Stat Ann secs 23:9-3 to 23:9-5, 23:9-9 to 23:9-11, 23:9-15, 23:9-17 to 23:9-21 (1940); N J Stat Ann secs 23:9-6 to 23:9-8, 23:9-12 to 23:9-14, 23:9-16 (Supp 1968).

Descriptors: *Fishing, *Delaware River, *Nets, *Water pollution control, Fish conservation, Sport fish, Bait fishing, Riparian rights, Water law, Legislation, Fish toxins, Fish management, Sport fishing, Public rights, Commercial fishing, Fishing gear, Explosives, New Jersey, Pennsylvania, Navigable waters, Low water mark, Interstate rivers, Water resources development, Legal aspects.
Identifiers: *Penalties (Criminal), *Interstate cooperation, Fishing seasons, Trenton Falls.

Within the boundaries prescribed, taking or catching, or attempting to take or catch, any game, food, or bait fish may be done only as set forth in the State Fish and Game Code or the provisions of this article. Impeding navigation with any fishing net or device is prohibited. The interference with any fishing device being lawfully used, or its destruction without cause, and the allowance of any poison, explosive, or other deleterious substance to enter the waters described in this section, unless all practicable means of avoiding pollution have been taken is also prohibited. The provisions of this article are enforceable through arrest and prosecution by any authorized officer of New Jersey or Pennsylvania. Such arrest may be made on the waters described or on the shores of those waters if such are within the jurisdiction of either state. (Harris-Fla)
W69-07034

WATERS AFFECTED BY ARTICLE; COMMON RIGHTS TO FISH; GAME, BAIT AND FOOD FISH DEFINED.

N J Stat Ann secs 23:9-3 to 23:9-5 (1940).

Descriptors: *New Jersey, *Pennsylvania, *Sport fishing, *Bait fishing, Water law, Legislation, Public rights, Fishing, Low water mark, Fish managment, Commercial fishing, Navigable waters, Fish conservation, Bass, Sunfishes, Pikes, Trout, Sport fish, Delaware River, Legal aspects.
Identifiers: *Game fish, Trenton Falls.

The provisions in this act apply only to propagation, catching, taking, protection and destruction of fish in the waters of the Delaware River above and below Trenton Falls lying between the commonwealth of Pennsylvania and the state of New Jersey. Inhabitants of Pennsylvania and New Jersey shall enjoy a common right of fishery through the waters of the Delaware River, above and below Trenton Falls, between low water mark on each side of the river between the states, except as valid private fishing rights have been granted by either state. The term 'game fish' includes the varieties of bass enumerated by this section, the crappie, pike perch, pike, pickerel, or any form of trout. The term 'bait fish' means any species of minnows, killifishes, and stone catfish. The term 'food fish' includes all other varieties of fish. (Harris-Fla)
W69-07035

TAKING STURGEON; TAKING FOOD FISH WITH SCINE OR GILL NET; FINE AND FORFEITURE; USE OF CERTAIN NETS PROHIBITED; FINE AND FORFEITURE; PROHIBITED HOURS FOR FISHING; FINE AND FORFEITURE; USE OF PARALLEL NETS PROHIBITED.

N J Stat Ann secs 23:9-9 to 23:9-11, 23:9-15 (1940), as amended, (Supp 1968).

Descriptors: *Fish conservation, *Sport fish, *Bait fishing, *Nets, Riparian rights, Fish managment, Sport fishing, Public rights, Commercial fishing, Fishing gear, Legislation, Navigable waters, Herrings, Suckers, Delaware River, Regulation, Legal aspects.
Identifiers: Sturgeon, Trenton Falls, Penalties (Criminal).

Taking or attempting to take sturgeon, herring, suckers, or any other food fish above Trenton Falls with a scine or gill net, other than as prescribed by law, is prohibited. Violators of this section are subject to fine and forfeiture of all appliances. The use of a pound net or any anchored or fastened net in the Delaware River above or below Trenton Falls, and the use of any net to take fish within one-half mile of the mouth of any stream emptying into the Delaware River above or below Trenton Falls, is also prohibited. Violators are subject to fine and the forfeiture of all appliances. The use of a net between 2:00 p m Saturday and midnight Sunday above or below Trenton Falls, the use of a net set approximately parallel to the shore of the Delaware River below Trenton Falls or the use of any net in such a manner as to impede navigation is punishable by $100 fine and the forfeiture of all appliances. (Harris-Fla)
W69-07036

INTERFERENCE WITH OR INJURY TO NETS; USE OF EXPLOSIVES OR POISONOUS MATTER; POLLUTION OF WATERS; PURCHASE, SALE OR POSSESSION OF FISH EXCEPT DURING LAWFUL PERIOD PROHIBITED.

N J Stat Ann secs 23:9-17 to 23:9-19 (1940).

Descriptors: *New Jersey, *Fish toxins, *Explosives, *Water pollution control, Fish management, Commercial fishing, Nets, Fishing gear, Riparian rights, Sport fish, Legislation, Regulation, Water pollution sources.
Identifiers: Food fish, Proof.

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The wilful interference with or destruction of nets being lawfully used, without reasonable cause, or the drifting of a gill net over the waters of a shore fishery below Trenton Falls while the hauling seine is being used is punishable by a $20 fine. The placing of any explosive substance in the Delaware River for the purpose of killing fish, or allowing any deleterious matter to be emptied into said waters without the use of every practicable means to prevent pollution is prohibited. In prosecuting the above mentioned offense, it is not necessary to prove that such substances have actually caused the death of any particular fish. Violators are subject to $200 fine. The purchase, sale, or possession of any freshly killed game or food fish, except during the lawful period for catching the same and for 6 days after expiration of that period, is punishable by a fine of $10 for each fish. (Harris-Fla)
W69-07037

CONCURRENT JURISDICTION OF STATES; PROCEDURE FOR VIOLATIONS – ARREST AND PUNISHMENT OF VIOLATIONS; INTERFERENCE WITH OFFICERS; MANNER AND MEANS OF FISHING FOR GAME FISH.

N J Stat Ann secs 23:9-20, 20.1, 21 (1940), as amended, N J Stat Ann sec 23:9-6 (Supp 1968).

Descriptors: *New Jersey, *Pennsylvania, *State jurisdiction, *Sport fishing, Fishing gear, Legislation, Sunfishes, White perch, Yellow perch, Navigable waters, Shores, Fish management, Fish conservation, Legal aspects, Regulation.
Identifiers: Penalties (Criminal).

Pennsylvania and New Jersey have concurrent jurisdiction over violations of this article, within their respective jurisdictions. When Pennsylvania enacts a similar fish law any game protector, fish warden, or other person authorized, shall have the power to arrest any offender on any part of the Delaware River lying between the states or the shores thereof and to take such offender to trial in the state of the violation. The attempt to prevent an arrest by an authorized person for violation of fish laws or to prevent the carrying into effect any provisions of this article is punishable by a fine of $100. Fishing for game fish, sunfish, or white or yellow perch may only be done by methods prescribed in the state fish and game code. If no method is prescribed, only rods and lines, hand lines, or trolling lines and artificial bait may be used. The number of devices may not exceed the prescriptions in the code, or if not prescribed, 2 of 1 or the other devices named. Violators are subject to a $20 fine. (Harris-Fla)
W69-07038

MEANS OF FISHING FOR BAITFISH, FOOD FISH; GAME FISH; SEASON; CATCHING FISH WITH LINES.

N J Stat Ann secs 23:9-7, 8, 12 (Supp 1968).

Descriptors: *New Jersey, *Bait fishing, *Commercial fishing, *Sport fishing, Fish conservation, Fish management, Legislation, Fishing gear, Regulation, Trout, Legal aspects.
Identifiers: *Food fish, *Trenton Falls, *Fishing seasons, Penalties (Criminal).

No person may fish for bait or food fish except with devices prescribed by the State Fish and Game Code, or, if none are prescribed, with devices enumerated in this section. Any violator using a device other than those prescribed in the code or in this section subject to a fine of $20.00. The number of devices used in fishing for food fish may not exceed that number prescribed in the Code, or, if none is prescribed, 3 of 1 or the other device named. The use of a prohibited device, or the use of a legal device contrary to promulgated regulations, is punishable by a fine of $20.00. Catching food fish as prescribed by section 23:9-6 is lawful at any time of the year. Fishing or taking of game fish must be as provided in the State Fish and Game Code. Any form of trout may only be taken between April 15 and July 31 unless otherwise provided in the code. Violators are punishable by a fine of $10.00 for each fish taken. (Harris-Fla)
W69-07039

BAG LIMIT ON GAME FISH; USE OF EELPOTS AND FYKE NETS; SIZE OF CERTAIN FISH.

N J Stat Ann secs 23:9-13, 14, 16 (Supp 1968).

Descriptors: *New Jersey, *Fish conservation, *Nets, *Sport fish, Regulation, Legal aspects, State governments, Legislation, Carp, Catfishes, Suckers, Eels, Fishing gear, Legal aspects.
Identifiers: *Bag limits, *Eelpots, *Fyke nets, Fishing season, Penalties (Criminal).

The taking, killing, or possession of more gamefish than the limit prescribed by the code for one day is punishable by a fine of $20.00 for each fish in excess of the limit. The use of eelpots and fyke nets without wings during any period prescribed in the State Fish and Game Code, or, if no period is prescribed, from June 1, to July 1 is unlawful. However, it is lawful to use such devices as prescribed by the code or from July 1 to May 31 to catch carp, catfish, eels and suckers. All other fish caught must be returned unharmed immediately to the water. The device must meet the specifications of this section of the code. Violators are subject to $20.00 fine and forfeiture. No person may catch or attempt to catch fish of greater weight or less length than provided by the State Fish and Game Code or this section. Any such fish caught must be returned immediately to the water. Nothing in this section shall be construed so as to prevent fishery authorities of New Jersey or Pennsylvania from capturing fish of any size from any waters at any time of year or in any manner for purposes of propagation or stocking. Violators shall be subject to a fine of $10.00 for each fish caught and in possession. (Harris-Fla)
W69-07040

POWERS AND DUTIES OF COMMISSIONER OF CONSERVATION.

N Y Unconsol Laws secs 1305, 1307 (McKinney Supp 1968).

Descriptors: *New York, *Flood control, *Eminent domain, *Appropriation, State governments, Federal government, Condemnation, Projects, State jurisdiction, Cost allocation, Federal project policy, Project planning, Flooding, Easements, Administrative agencies, Compensation, Legislation, Legal aspects, Adjudication procedure, Land regulation.

The Commissioner of Conservation is authorized to supervise the state's participation in a federal flood control program. He may perform any acts necessary to carry out the authorized projects and shall conform to the regulations of the federal government. The Commissioner shall acquire by appropriation any property or interest necessary for the successful completion of the projects. Upon filing with the Department of State a description of any property necessary for a project, the officers of the state may immediately enter upon and take possession of the land. Each owner affected by the appropriation shall be served with notice and the fact that such service has been accomplished shall be recorded. An occupant of any land appropriated may be removed after proper proceedings. The Commissioner may settle claims for the value of the property appropriated, or the owner may file a claim in the court of claims. The Commissioner or his agents may enter any property for the purpose of making tests or surveys in connection with a project. (Helwig-Fla)
W69-07041

STRICKLAND V STATE (HIGHWAY CONSTRUCTION AND SURFACE WATER DRAINAGE).
166 NYS 2d 870-873 (Ct Cl 1957).

Descriptors: *New York, *Road construction *Drainage systems, *Prescriptive rights, Storm ru noff, Rainfall, Flood damage, Culverts, Surfac waters, Water rights, Diversion, Natural flow, Judi cial decisions, Excessive precipitation, Obstructio to flow, Discharge (Water), Legal aspects.
Identifiers: *Negligence, *Burden of proof, *Proxi mate cause.

Claimant sought to recover for damages allegedl caused when the state collected and discharge surface water upon his land from a drainage systen on a state highway. Claimant's property lay partl in the natural line of drainage and directly in lin with any overflow from the state's highway culvert After heavy rains, the culvert became plugged wit debris of unknown origin, and claimant's lan became flooded. Claimant gave no notice to th state of any defect in the culvert. The court o claims held that the state's surface water drainag course had existed uninterrupted, adverse, an under claim of right for 15 years; this being so th state was held to have acquired a prescriptive righ to maintain the drains but not to cause flooding t plaintiff's land. The court felt that since the land had previously been flooded, and since claiman had not proved negligent construction of th highways or diversion of surface waters caused b improperly constructed or plugged culverts, th claimant failed to prove negligence or a causal rela tionship. The court directed a verdict for the state (Harris-Fla)
W69-07042

COOPER V CITY OF READING (LIABILITY UNDER ATTRACTIVE NUISANCE DOCTRINE FOR MAINTENANCE OF DRAINAGE POOL).

392 Pa 452, 140 A 2d 792-799 (1958).

Descriptors: *Pennsylvania, *Ponds, *Drowning *Legal aspects, Safety, Hazards, Cities, Drainag systems, Storm drains, Dry beds, Ownership o beds, Easements, Barriers, Local governments, En croachment, Judicial decisions.
Identifiers: *Attractive nuisance, *Negligence *Liability, *Legal duty, Fencing, Knowledge Governmental functions.

Defendant city's storm sewer drainage systen discharged water into an abandoned canal bed forming a pool pursuant to an easement. A portio of the pool encroached upon defendant railroad' property. The pool was unfenced and childre frequently played there. One drowning had previ ously occurred. Plaintiff's children drowned when ice on the pool broke at its deepest point. The tria court granted judgment for defendant not withstanding verdicts for plaintiff. The supreme court held the attractive nuisance doctrine t apply, but felt defendant railroad did not have, no should it have had, knowledge that the pool had en croached upon its land. The city was held to have exercised sufficient control over the canal bed b exercise of its easement to fill the pool with water and had a duty to make it a safe place. The cour felt the peril presented by the illusive depth at th pool's center could not have been known by chil dren, and that the city's purpose in maintaining th unfenced pool did not outweigh the danger to th children. The court found no government functio in the passive allowance of the pool, and reinstate the verdict against defendant city. (Harris-Fla)
W69-07044

DIVISION OF WATERS, SOILS AND MINERALS.

Minn Stat Ann secs 105.37 to 105.55, 105.60 t 105.64, 105.71 to 105.81 (1964), as amended (Supp 1968).

Descriptors: *Legislation, *Administrative agen cies, *Minnesota, *Water resources development Hydraulic structures, Dams, Adjudicatio procedure, Stop logs, Reservoirs, Water con veyance, Waterworks, Water supply, Water con servation, Water utilization, Legal aspects, Stat

overnments, Permits, Regulation, Impounded vaters.

Minnesota regards all state waters which are capable of beneficial public use to be public waters subject to state control. The Commissioner of Conservation is charged with development of a water resources program. The Commissioner's duties include establishing the high water level of lakes and issuing permits to construct dams. It is a misdemeanor for any person or agency to use public waters without approval of the Commissioner. The Director of the Waters Division of the Conservation Department is required by statute to be an engineer skilled in hydraulics. The Director is responsible for physical surveys including surface and groundwater resource evaluation. Easements for the use of stoplogs to provide water project efficiency may be procured by the Commissioner. Operation of state owned hydraulic works may be assigned to local governments. Prior to diverting or draining waters, mining interests are required to obtain a permit from the Commissioner. A State Water Resources Board is to be appointed by the governor. (Katz-Fla)
W69-07045

WATER RESOURCES, CONSERVATION.
Minn Stat Ann secs 105.37 to 105.41 (1964_0, as amended, (Supp 1968).

Descriptors: *Minnesota, *Legislation, *Administrative agencies, *Drains, Ditches, Runoff, Surface waters, Groundwater, Base flow, Tiles, Precipitation excess, Water resources development, Hydraulic structures, Adjudication procedure, Water conveyance, Waterworks, Water supply, Water conservation, Water utilization, Legal aspects, State governments, Permits, Regulations, Impounded wastes, Dams, Reservoirs, Condemnation, Eminent domain.

Subject to existing rights, all waters capable of substantial beneficial public use are declared to be public waters subject to state control. The Commissioner shall devise a water resources conservation program contemplating conservation, allocation, and development of all waters within the state, surface and underground, in the public interest. The Commissioner shall be guided by such a program in consideration of issuance of permits for construction of dams, reservoirs, and other control structures. The Commissioner is empowered to acquire property to implement this program by condemnation. The Water Division Director shall make such engineering surveys and reports as the Commissioner shall direct. A report on all future public ditches shall be filed with the Director. The Director is required to publish runoff data and information concerning the capacity of the drains within the state. The Director is empowered to conduct inspections of manufacturing plants. The Director is authorized to appear as an expert witness on behalf of the state in any matter affecting water within the state. (Katz-Fla)
W69-07046

WATER RESOURCES, CONSERVATION.
Minn Stat Ann secs 105.41 to 105.45 (1964), as amended, (Supp 1968).

Descriptors: *Minnesota, *Legislation, *Administrative agencies, *Water resources development, Hydraulic structures, Dams, Adjudication procedure, Stoplogs, Reservoirs, Water conveyance, Waterworks, Water supply, Water conservation, Water utilization, Legal aspects, State governments, Permits, Regulation, Impounded waters, Eminent domain, Condemnation.

It is unlawful for any person or legal person to use or appropriate any surface or groundwaters of the state without a permit from the Commissioner. Such permits may be subject to conditions attached by the Commissioner in the public interests. Permit holders must obtain permission before increasing authorized water usage. It is unlawful for any person or the state to construct, abandon, or reconstruct any reservoir or dam without a permit from the Commissioner. The Commissioner, upon request, shall affix the natural high water mark of any public body of water. All permits required under this section shall be accompanied with specific plans, maps, and specifications concerning the proposed water appropriation. The Commissioner may, in his discretion, waive public hearing on permit applications. A disappointed party may demand a hearing within ten days from the denial of his application. Such hearings shall be public, and adequate notice of time and place shall be afforded all parties. Any issued permit is subject to cancellation in the public interest. (Katz-Fla)
W69-07047

WATER RESOURCES, CONSERVATION.
Minn Stat Ann secs 105.45 to 105.60 (1946), as amended, (Supp 1968).

Descriptors: *Minnesota, *Legislation, *Administrative agencies, *Water resources development, Hydraulic structures, Dams, Adjudication procedure, Stoplogs, Reservoirs, Water conveyance, Waterworks, Water supply, Water conservation, Water utilization, Legal aspects, State governments, Permits, Regulation, Impounded waters, Public benefits, Navigation, Wildlife conservation.

All orders of the Commissioner shall be based on findings of fact made on substantial evidence. The Commissioner shall grant or deny permit applications in furtherance of the public interest. Notice of such orders shall be served by publication or mail within 60 days after the completion of the hearing. The Commissioner shall fix the time within which all authorized construction must be completed or within which any appropriation must be completed; such period shall not exceed 5 years. Any party in interest may appeal from any determination of the Commissioner to the county district court within 30 days after notice of such order. The Commissioner, in the interest of navigation, water supply, wildlife conservation or in the general public interest may construct and maintain any waterworks necessary to maintain a uniform water level. The Commissioner is in charge of all state dams. The Commissioner may require artesian well owners to prevent wastes. Any violation of this statute is a misdemeanor. (Katz-Fla)
W69-07048

STOPLOGS, EASEMENTS.
Minn Stat Ann secs 105.60 to 105.71 (1964), as amended, (Supp 1968).

Descriptors: *Minnesota, *Legislation, *Administrative agencies, *Water resources development, Hydraulic structures, Dams, Adjudication procedures, Stoplogs, Reservoirs, Waterworks, Water conveyance, Water supply, Water conservation, Water utilization, Legal aspects, State governments, Permits, Regulation, Impounded waters, Public benefits.

In order to provide effective regulation of the waters controlled by the Lac Qui Parle water control project, the Commissioner is authorized to acquire, by purchase or condemnation, all easements that may be necessary for the use of stoplogs. No more than five stoplogs may be used at any one dam, and stoplogs will not be placed from freeze until 1 April of each year. The Commissioner may exercise and use easements or rights so acquired for stoplog use upon the commencement of condemnation proceedings. The acquisition costs of such easements shall be born by the water control project. The Commissioner may transfer operation of a state dam to any authorized political subdivision of the state in the furtherance of public interest. Permits allowing drainage, diversion, control, or use of waters necessary in certain mining operations may be issued by the Commissioner. Permits to mining concerns shall issue only upon a showing that no other economical and feasible mode of extraction is available and that such operations shall be in the public interest. Any permit so issued shall be irrevocable for the term thereof. (Katz-Fla)
W69-07049

WATER RESOURCES BOARD; IMPOUNDING AND DIVERSION OF DRAINAGE SYSTEM WATERS.
Minn Stat Ann secs 105.71 to 105.81 (1964), as amended (Supp 1968).

Descriptors: *Minnesota, *Legislation, *Administrative agencies, *Water resources development, Hydraulic structures, Dams, Adjudication procedure, Stoplogs, Reservoirs, Water conveyance, Waterworks, Water supply, Water conservation, Water utilization, Legal aspects, State governments, Permits, Regulation, Impounded waters.

A Water Resources Board is to be appointed by the governor. The Board shall serve as a forum in which inconsistencies in state water law and policy may be resolved. The Board will also determine questions of state water policy de novo where necessary. The Board's intervention is invoked by petition requesting referral of a question of water policy involved in a proceeding. A properly filed petition abates the proceeding until the Board acts. The Board shall act as quickly as possible in convening a public hearing and in formulating its recommendations. To facilitate Board determinations, the Board may subpoena necessary witnesses and records. Upon proper petition and posting of bond, the county board may approve local projects involving impoundment and diversion of drainage system waters. (Katz-Fla)
W69-07050

POWER TO ACQUIRE LAND, CONSTRUCT AND EQUIP SEWERAGE SYSTEM.
Conn Gen Stat Ann sec 7-247 (1960).

Descriptors: *Connecticut, *Sewage districts, *Condemnation, *Cities, Sewage, Sewage disposal, Sewage treatment, Sewers, Wastes, Environmental sanitation, Drainage systems, Storm drains, Regulation, Administrative agencies, Management, Storm runoff, Real property, Right of way, Eminent domain, Contracts, Control, Legislation, Local governments, Legal aspects.

Any city may acquire, construct, and operate a sewerage system or systems. For that purpose, the city may enter upon and acquire property by purchase, condemnation, or other means. Cities may establish rules for the operation of the system, including regulation of discharge of sewage or any storm drain runoff into the system which they feel will adversely affect its operation. Cities may contract with any person or with any other city to provide or obtain sewerage system services for any sewage. The sewer authority shall: (1) establish rules for the transaction of its business; (2) keep records of its proceedings; and (3) designate an officer to be the custodian of its books. (Shevin-Fla)
W69-07051

STREAM OBSTRUCTION AND DUMPING.
Conn Gen Stat Ann secs 19-312 to 19-315 (1960), as amended, (Supp 1968).

Descriptors: *Connecticut, *Natural flow, *Obstruction to flow, *Alteration of flow, Legislation, Sedimentation, Watercourses (Legal), Natural streams, Navigation, Navigable waters, Docks, Piers, Islands, Landfills, Wastes, Sludge, Damages, Barriers, Deposition (Sediments), Water pollution.
Identifiers: *Nuisances.

Any person who intentionally deposits in any watercourse material which will be naturally carried to another's land and cause damage thereto shall pay double damages unless he removes such substance within a reasonable time after notice of

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the damage. Any person who obstructs navigation by placing foreign objects in navigable waters shall be fined and ordered to remove such substances. If he fails to do so within thirty days, the substance may be removed at his expense. This section does not apply to wharves. Any person who unlawfully sinks any material in the Connecticut River so as to obstruct or divert the natural flow, shall be fined and ordered to remove the material. (Stewart-Fla)
W69-07052

ALTERATION OF HIGHWAYS.
For primary bibliographic entry see Field 04A.
W69-07053

LEGAL CONTROL OF THERMAL POLLUTION,
Max N. Edwards.
Nat Resources Lawyer, Vol 11, No 1, pp 1-6, Jan 1969. 6 p, 6 ref.

Descriptors: *Electric powerplants, *Thermal pollution, *Aquatic environment, *Water quality control, Electric power industry, Electric power demand, Thermal water, Nuclear powerplants, Heated water, Nuclear energy, Cooling, Cooling water, Water temperature, Ecology, Oxygen, Technology, Pollution, River flow, Turbulence, Water quality act, Federal government, Recreation, Permits, Legislation, Flow augmentation, Planning standards, Administrative agencies, Legal aspects.
Identifiers: *Waste heat discharge, Fed Water Pollution Control Act, Injunctions (Mandatory), Injunctions (Prohibitory).

Thermal pollution is rapidly becoming a serious problem. As the nation's need for more electric utility plants becomes greater, and the industry's use of nuclear powered generating plants becomes more widespread, thermal pollution caused by waste heat discharges becomes more prevalent. Four solutions are possible: (1) reduce the heat wasted by increased efficiency; (2) make constructive use of the heat; (3) adjust the duration of a temperature deviation; and, (4) manage the environment so as to reduce the impact of heat. Standards for water quality control do exist; however, the Federal Water Pollution Control Act does not allow for injunctive relief to abate the threatened thermal pollution. The courts expect public uses to be considered before federal licenses are granted. Several proposals have been made to create a new authority to assure compliance with water quality standards before licensing. The three major proposals are: (1) review of compliance with thermal standards by the licensing agency; (2) recommendations of standards by the Department of the Interior; and, (3) certification of compliance by the Department of Interior. Regardless of the procedure followed, thermal pollution is an immediate critical, multi-faceted problem requiring attention. This country requires abundant power, but the tapping of new power sources must be achieved with minimum pollution of our streams and rivers. (Shevin-Fla)
W69-07054

BRIDGE CONSTRUCTION AND MAINTENANCE.

Conn Gen Stat Ann secs 13a-90, 13a-94, 13a-99, 13a-101, 13a-112 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *Bridge construction, *Cost allocation, *Maintenance, Artificial watercourses, Highways, Legislation, Repairing, Cities, Navigable waters, State governments, Administrative agencies, Flood control, Projects, Regulation, Bridges, Civil engineering, Cost sharing, Streams, Transportation, Construction costs, Equitable apportionment, Embankments.

Any bridge or passageway over an artificial watercourse built before May 10, 1957 and located on a highway maintained by the Commissioner of Highways shall be maintained by the owner of the watercourse. If the highway and bridge require expansion or reconstruction, the cost shall be charged to the state and the Commissioner shall thereafter maintain the bridge. Any structures or embankments to be built over or adjacent to streams in connection with state highway improvement projects and flood control shall conform to the requirements of the water resources commission for sizes and location of waterways. Towns shall, within their respective limits, build and repair all necessary highways and bridges unless the duty belongs to some particular person. Any bridge or passageway over an artificial watercourse on a highway not maintained by the Commissioner shall be constructed and maintained by the owner; however, if the town finds the bridge to have become unsafe for the traveling public, it can order the construction of a new bridge and pay an equitable portion of the reconstruction cost. No bridge without a draw shall be built across waters navigated by commercial vessels whose passage would be impeded by such bridge. (Stewart-Fla)
W69-07055

CONTRACTS FOR ABATEMENT OF POLLUTION.
W Va Code Ann sec 16-13-22b (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Cities, *Pollution abatement, *Industrial wastes, Sewage treatment, Legislation, Public benefits, Water pollution, Cost allocation, Sewage disposal, Water pollution treatment, Water pollution sources, Treatment facilities, Contracts, Maintenance, Public health.

When necessary to protect public health, a municipality may contract with any industrial establishment for the operation of sewerage facilities to abate or reduce water pollution caused by industrial wastes. The industrial establishment shall periodically pay the municipality amounts sufficient to compensate it for the costs of operating and maintaining sewerage facilities. (Stewart-Fla)
W69-07056

GRANT V UNITED STATES (SEWAGE DISPOSAL IN TIDAL WATERS).
192 F 2d 482-486 (4th Cir 1951).

Descriptors: *North Carolina, *Sewage disposal, *Oysters, *Tidal waters, Ownership of beds, Sewage, Natural use, Chemical wastes, Federal government, Remedies, Judicial decisions, Legal aspects, United States, Leases, Legislation, Damages, Relative rights.
Identifiers: Oyster beds.

Plaintiffs leased certain oyster beds from the State of North Carolina. They brought action against the United States under a special act of Congress conferring a right of action for damage to such lands caused by the dumping of untreated sewage and laundry waste into the tidal waters in which the lands were situated. The district court entered a decree for the United States, and plaintiff appealed. This court found that the intent of the legislature in enacting the special legislation was that the United States should be held to the same degree of liability as a private person or a municipality when disposing of pollutants in tidal waters. Under state law, the rule was that there was no liability for dumping sewage into tidal waters since there was ordinarily no private ownership of lands beneath such waters. However, when the state, representing the public, leased land beneath tidal waters for the cultivation of oysters, the right of the public to dump sewage was restricted; only such sewage as would not harm the rights of the lessee could thereafter be emptied into the waters. The United States was held liable. (Gabrielson-Fla)
W69-07057

HERBERT V T L JAMES AND CO (CONDEMNATION WITHOUT COMPENSATION).

224 La 498, 70 So 2d 102-109 (La 1954).

Descriptors: *Highways, *Riparian rights, *Louisiana, *State governments, Navigable waters, Navigation, Streams, Damages, Remedies, Judicial decisions, Legal aspects, Right of way, Condemnation, Compensation, Real property, Land, Public benefits.
Identifiers: *Servitudes, Injunctions (Prohibitory).

Plaintiff owned land on a navigable stream. Across the front of this land, close to and parallel to the stream, lay a state highway. Defendants, in widening this highway, cut a road bed across plaintiff's front yard. Plaintiff sought injunctive relief and an award of damages. Plaintiff argued that defendants could not widen the highway without granting compensation for the land taken. Defendants based the legality of their actions on certain state statutes which provided that lands bordering on navigable streams owe servitudes for general road purposes without any right of compensation. The trial court issued the injunction, and defendants appealed. The court of appeals reversed, and plaintiff appealed. The supreme court, after examining the history of the statutes, reinstated the decision of the trial court. The court held that the servitude imposed by the statutes was not intended to serve any public purpose other than that incident to the nature, navigable character, or use of the stream. The decision to widen this highway was made in furtherance of other objectives. (Gabrielson-Fla)
W69-07058

CITY OF MIAMI BEACH V HOGAN (CONDEMNATION OF OCEAN-FRONT PROPERTY).

63 So 2d 493-495 (Fla 1953).

Descriptors: *Florida, *Condemnation, *Oceans, *Beaches, Recreation facilities, Atlantic Ocean, Cities, Condemnation value, Navigable waters, Parks, Recreation, Legislation, Zoning, Land use, High water mark, Low water mark, Legal aspects, Judicial decisions, Shores, Public rights, Local governments.
Identifiers: Injunctions (Prohibitory).

The city filed a petition condemning respondent's ocean front property for parks purposes pursuant to a city ordinance. Respondent filed suit attacking the reasonableness of the ordinance and sought to enjoin the city from condemning her property. The lower court held for the respondent, and certiorari was granted. The supreme court stated that a regularly enacted ordinance is presumed to be valid until the contrary is shown and that the burden of establishing invalidity rests on the complaining party. In reference to zoning ordinances, the court stated that it will not substitute its judgment for that of the city; the ordinance will be sustained unless it is shown to be clearly unreasonable. The court held that the people of a municipality have a right to use the ocean and the land lying between the high water mark and the low water mark for the purposes generally recognized. They further said that, if all the ocean front property of Miami Beach was devoted to hotel purposes, the citizens could not use the ocean unless they became a guest at a hotel. The decision of the lower court was reversed in favor of the city. (Shevin-Fla)
W69-07059

RIGHTS, POWERS, DUTIES; SEVERAL POLITICAL SUBDIVISIONS.

Minn Stat Ann secs 471.05, 471.06, 471.10, 471.11 (1963), as amended, (Supp 1968).

Descriptors: *Minnesota, *Legislation, *Docks, *Administrative agencies, Navigable waters, Structures, Organizations, Cooperatives, Transportation, Rivers, Inland waterways, Navigation, Excavation, Construction, Eminent domain, Con-

demnation, Abatement, Regulation, Legal aspects, Local governments.

In Minnesota, any village which has no railroad connections, is situated adjacent to navigable waters and is dependent upon such navigable waters for transportation, may combine with other towns in the vicinity to create an organization for the purpose of building, maintaining, and operating one or more docks or wharves on such waters. No such territory may organize unless when so combined it will constitute one continguous body of land. An election to determine whether to form such an organization and whether to finance it through the issuance of bonds shall be called by the various towns and villages upon petition signed by at least one per cent of the voters of such communities. Notice and conduct of such elections is regulated. If the proposition is approved by the various communities, a commission, comprised of various chief officials, shall be formed. The commission shall have the authority to purchase sites and to conduct the operation. The governing body of any political subdivision may regulate the maintenance or abandonment of dangerous excavations and may provide penalties for violations. Such installation may be defined as a public nuisance and thus be made subject to laws relating to the abatement of nuisances generally. (Wheeler-Fla)
W69-07060

ELECTRICAL.
Minn Stat Ann secs 455.11, 455.15 to 455.22 (1963) as amended (Supp 1968).

Descriptors: *Minnesota, *Easements, *Dams, Hydroelectric plants, Cities, Structures, Powerplants, Electric powerplants, Industrial plants, Electric power, Electric power production, Hydroelectric power, Water levels, Regulation, Eminent domain, Public utilities, Flow, Government finance, Pricing, Electric power rates.
Identifiers: Corporations (Public).

Any city of the third class owning and operating a power dam for purposes of generating electricity for municipal use may acquire necessary flowage rights under the power of eminent domain over and upon any property for the purposes of increasing the height of the dam. Any city situated upon a river may form a public corporation to develop water power facilities to supply electricity to the city and state institutions therein. Adjacent cities shall be invited to unite in securing the organization; however, acceptance of such invitation by the adjacent city is not a prerequisite for proceeding with formation of such corporation. The manner of organizing the corporation and its objects, purposes, election of officers, rates, and bond issuance are regulated. The corporation is empowered to acquire developed water power near the cities, to acquire necessary lands and rights, and to provide itself with suitable plants and with necessary means of distribution. (Wheeler-Fla)
W69-07061

LICENSES, TAKING OF GAME AND FISH.
Minn Stat Ann secs 98.45, 98.47, 98.48 to 98.52 (1947) as amended (Supp 1968).

Descriptors: *Minnesota, *Wildlife, *Permits, Fishing, Hunting, Birds, Natural resources, Administrative agencies, Local governments, State governments, Wildlife conservation, Wildlife management, Small animals (Mammals), Trapping, Furbearers, Recreation, Fish, Legislation, Legal aspects, Costs.

Except as permitted by statute, no person may take, buy, sell, transport, or possess protected wild animals without a proper license. Such license must be carried on the person of the individual while engaged in acts covered by the license. Licensing of aliens, non-residents, and non-resident students are provided for in special provisions. Certain exemptions to the licensing law are set out. The Commissioner may issue special permits for such activities as scientific expeditions, field dog trials, taking certain animals as pets and establishing, rifle ranges. The procedure for application, issuance, and revocation of licenses and permits are set out. (Helwig-Fla)
W69-07062

COMMERCIAL FISHING.
Minn Stat Ann secs 102.23 to 102.30 (1964) as amended (Supp 1968).

Descriptors: *Minnesota, *Commercial fishing, *Legislation, *Regulation, Fishing, Commercial shellfishing, Commercial fish, Fisheries, Fishing gear, Freshwater fish, International waters, Shellfish, Clams, Mussels, Fish, Rivers, Lakes, Administrative agencies, Legal aspects, Nets, Equipment, Seasonal.
Identifiers: Penalties (Criminal).

Mussels, clams, and fish, taken according to law, may be bought and sold during open seasons plus 7 days; if frozen during the season, they may be bought and sold anytime. The regulations as to the size and number of mussels allowed to be taken and as to the equipment permitted to be used in their taking are set out. The equipment and method restrictions for taking commercial fish in certain rivers and lakes are listed. No person shall knowingly obstruct or interfere with any commercial fishing operation, remove any fish from nets, or injure nets. The Commissioner of Conservation may authorize and make rules concerning the transportation, sale, and disposal of fish taken within the Red Lake Indian Reservation. (Helwig-Fla)
W69-07063

DRAINAGE SYSTEMS.

Minn Stat Ann secs 106.641 to 106.673 (1964), as amended, (Supp 1968).

Descriptors: *Minnesota, *Drainage systems, *Ditches, *Public benefits, Conservation, Drainage, Drainage practices, Flood control, Laterals, Pipes, Streams, Wildlife, Surface waters, Repulsion (Legal aspects), Legislation, State governments, Local governments, Highways, Construction, Legal aspects, Maintenance, Diversion, Obstruction to flow, Assessments, Repairing, Compensation, Ditch grass.
Identifiers: Penalties (Criminal).

Any person who obstructs or injures any public drainage system, who wilfully alters any stakes set in any drainage system or who digs without authority any drain which outlets into any public drain shall be guilty of a misdemeanor. After the construction of any ditch system, if waters are diverted from any land being assessed for such systems so that the land no longer benefits from the system, the owner of such land may petition for removal from the system. When a drainage ditch no longer benefits the public, owners of land assessed for its construction may petition for its abandonment. After abandonment of a ditch, the county shall no longer maintain or repair it. Any authority charged with determining the public utility of any drainage system will give due consideration to conservation measures. Any drainage system affecting land owned for purposes of conservation of natural resources shall be permitted to exist only if beneficial to the public interest. Ditches within a drainage system may be planted with a permanent grass. (Helwig-Fla)
W69-07064

HIGHWAYS AND PORTAGES.

Minn Stat Ann secs 163.111, 163.13 (1960) as amended (Supp 1968).

Descriptors: *Minnesota, *Highways, *Local governments, *Drainage systems, Roads, Public benefits, Legislation, Legal aspects, Relative rights, Regulation, Administrative agencies, Land tenure, Ditches.

When considering a petition for vacation of a county highway, the county board shall determine whether the lateral ditches are essential for drainage of adjacent land. If the drainage is necessary for the general health, the board may cause vacation of the highway. Any person who owns land in a county may petition for establishment, alteration, or vacation of a county highway or portage. After a hearing, the board shall, by resolution, make a determination whether to grant or deny such petition. If the petition is denied, petitioner may appeal, and there shall be a trial de novo. (Helwig-Fla)
W69-07065

BRIDGES ACROSS DIVERSION CHANNELS.
Minn Stat Ann sec 163.15 (1960) as amended (Supp 1968).

Descriptors: *Diversion structures, *Access routes, *Navigable waters, *Minnesota, Legislation, Legal aspects, Roads, Highways, Bridges, Streams, Local governments, State governments, Easements, Relative rights.

If any county diverts the channel of a navigable stream in order to improve a road, and the diverted stream crosses private property so as to deprive the owner of access to the road, such owner may grant to the county a perpetual easement across the property and the county shall build a bridge thereon. (Helwig-Fla)
W69-07066

DRAINAGES SYSTEMS AFFECTING HIGHWAYS; ALTERATIONS.
Minn Stat Ann sec 163.17 (1960) as amended (Supp 1968).

Descriptors: *Minnesota, *Highways, *Operation and maintenance, *Drainage systems, Ditches, Legislation, Legal aspects, Alteration of flow, Public benefits, Relative rights, Administrative agencies, Construction.

If it is desirable in the construction or maintenance of a highway to make a minor alteration in a public ditch system, the county board by resolution or district court by order, after a hearing, may authorize such alteration. (Helwig-Fla)
W69-07067

WITKE V STATE CONSERVATION COMM'N (TAXATION OF PUBLIC USE OF PUBLIC WATERS).
56 NW 2d 582-589 (iowa 1953).

Descriptors: *Iowa, *Navigable waters, *Taxes, *Public rights, Riparian rights, Judicial decisions, Public benefits, Administrative agencies, State governments, Permits, Boats, Lakes, Transportation, Compensation, Navigation, Water rights, Competing uses, Regulation, Legislation, Legal aspects, Financing.
Identifiers: *Constitutional law, Due process.

Plaintiff brought suit to have a state statute declared unconstitutional. The statute provided that no one could operate a commercial concession on any state-owned lands or waters without first obtaining a permit and paying an appropriate fee. Plaintiff owned several boats which he operated as taxis on the navigable waters of a lake. The state held the title to the lake waters but only in the capacity as trustee for the public. Plaintiff contended that the tax deprived a citizen of property without due process of law. The court upheld a judgment for the plaintiff, ruling that, since the waters are public, any person has a right to use the waters for whatever purpose he desired, as long as such use did not interfere with the rights of others. A state may not sell the right to use public waters.

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However, the court did rule that, if the state has improved the waterway or provided other facilities, a reasonable fee may be exacted in order to pay for such improvements. (Stewart-Fla)
W69-07068

KIMBLE V ANDERSON-TULLY CO (TITLE TO ACCRETION).

16 F R D 502-507 (E D Ark 1955).

Descriptors: *Arkansas, *Accretion (Legal aspects), *Riparian rights, *Islands, Mississippi River, Rivers, Navigable waters, Judicial decisions, Remedies, Legal aspects, Boundaries (Property), State governments, Riparian land.
Identifiers: *Ownership of accretion.

Plaintiff brought action to establish title to land allegedly formed by accretion. The land in question had become attached to an island which plaintiff owned. Defendant contended that the accreted land formed an independent island. Defendant filed a motion for summary judgment based on a plea of res judicata. The court denied the motion on the ground that a close and doubtful question of law was presented. No Arkansas cases were directly on point. In discussing the Arkansas policy towards accreted lands, the court noted that accretions to riparian lands are private property belonging to the riparian owners; lands which form islands in a navigable stream become, subject to a few exceptions, property of the state. (Gabrielson-Fla)
W69-07069

KIRSCHMAN V COCHRAN (TITLE TO ACCRETION).

241 SW 2d 9-13 (Mo 1951).

Descriptors: *Accretion (Legal aspects), *Land tenure, *Missouri, *Riparian land, Judicial decisions, Banks, Riparian rights, Navigable waters, Shorelines, Land forming, Legal aspects, Boundaries, Properties, Relative rights.
Identifiers: *Adverse possession, Ejectment.

Plaintiff brought action to quiet title to property and to eject defendant. The dispute concerned the ownership of lands formed by accretion. Plaintiff contended that he held title to the accretion by virtue of his title to the main land, which he had acquired by adverse possession. Defendant conceded that plaintiff had good title to the mainland but contended that such fact had no bearing on the question of ownership of accretion. The court held for the plaintiff, ruling that accretion belongs to the land to which it attaches. It follows that the title to the mainland, whether such title was acquired by deed or by adverse possession, carries with it title to any accretions. If the mainland had been unoccupied, the accretion would have been in constructive possession of the true owner; however, since the land was held by adverse possession, the accretion was in actual possession of the adverse owner. It is not necessary that the accretion be held for the statutory period required to acquire title by adverse possession. Once title to the mainland by adverse possession is obtained, title to accretion follows. (Stewart-Fla)
W69-07070

STATE V NICHOLS (OWNERSHIP OF SHORELINES AND RIPARIAN RIGHTS).

44 NW 2d 49-59 (Iowa 1950).

Descriptors: *Iowa, *Nonnavigable waters, *Riparian land, *Land tenure, Ownership of beds, Taxes, Judicial decisions, State governments, Watercourses, High water mark, Public lands, Navigable waters, Lake shores, Lakes, Riparian rights, Federal government, Land use, Real property, Legal aspects, Boundaries (Property).
Identifiers: *Quiet title.

Plaintiff brought suit to vacate a decree which quieted title to certain shore land in the name of the defendant. Plaintiff contended that the shore lands were part of the bed of a navigable body of water. Since the state holds title to the beds of all navigable waters in trust for the public, plaintiff also claimed title to the surrounding shore lands. Defendant based his claim on a tax deed. Furthermore, defendant contended that since he was in possession, had built a house, and paid all taxes on the property, plaintiff must recover on the strength of his own title and not on a defect in defendant's title. The court found the waters adjacent to the tract to be nonnavigable. Under Iowa law, an owner of riparian land bordering on a nonnavigable lake has title up to the high water mark but not to the beds. Since this is so, the court affirmed a judgment for the defendant, ruling that he had title to the shore lands. (Stewart-Fla)
W69-07071

MAYOR AND CITY COUNCIL OF BALTIMORE V CANTON CO OF BALTIMORE (RIGHT TO BUILD PIERS).

47 A 2d 775-782 (Md 1946).

Descriptors: *Maryland, *Riparian rights, *Local governments, *Ownership of beds, Navigable waters, Piers, Docks, Permits, Littoral, Navigation, State governments, Rivers, Harbors, Compensation, Judicial decisions, Legal aspects, Remedies, Damages, Accretion (Legal aspects).

Plaintiff granted permits to defendant allowing extensions of certain piers built into navigable waters, subject to inspection and minor privilege charges. When defendant did not pay these annual charges, plaintiff brought suit claiming the right to make such charges. The trial court entered judgment for defendant, and plaintiff appealed. The court held plaintiff had no right or power to exact these minor privilege charges. It found that the riparian owner possessed a vested right to make improvements on his piers. He could not lawfully be deprived of this right without his consent. Plaintiff had no right to demand compensation for the privilege of exercising that right since in this case, the power to exact compensation for the exercise of a right would have been tantamount to the power to destroy such right. (Gabrielson-Fla)
W69-07072

IN RE HADLOCK (CONSTRUCTION OF A FISHING WEIR IN A MUNICIPAL COVE).
48 A 2d 628-631 (Me 1946).

Descriptors: *Maine, *Riparian rights, *Navigable waters, *Fishing, Obstruction to flow, Ownership of beds, Recreation, Relative rights, Shores, Tides, Low water mark, Legislation, Fisheries, Tidal waters, Cities, Legal aspects, Judicial decisions, Local governments, Permits, Riparian land, Boundaries (Property).
Identifiers: *Fish weir.

Petitioner had applied to the Municipal Officers of the town for a license to erect a fish weir or trap in front of his shore in the tidewaters of a cove within the town limits. After being denied such a license, he obtained a court order directing the Officers to issue the permit. An owner of shore property bordering the cove filed a bill of exceptions. The court held that rights appurtenant to property bordering on tidal waters stop at the low water mark and that the rights intended to be safeguarded by the license requirements are those such as unobstructed navigation and fishing and not intangible rights such as unobstructed view or sightly prospects. The court held that, under the statute in question, the ruling of the lower court ordering issuance of the license was correct, and the exceptions were dismissed. (Shevin-Fla)
W69-07073

BERGER V TOWN OF GUILFORD (BEACH OWNERSHIP).

136 Conn 71, 68 A 2d 371-378 (1949).

Descriptors: *Connecticut, *Boundaries (Property), *Land tenure, *High water mark, Public lands, Beaches, Judicial decisions, Recreation, Cities, Local governments, Easements, Seashores, Highways, Public benefits, Land use, Legal aspects.
Identifiers: *Quiet title.

Plaintiff brought suit for a judicial determination of the ownership of a beach area which defendant claimed was public. A highway ran through the property parallel to the beach. Defendant claimed that plaintiff's property ended at the highway while plaintiff claimed that his title extended to the high water mark, giving him ownership of the beach. Plaintiff's predecessor in title owned to the high water mark. The existence of the highway and its related incidents did not affect property boundaries; rather, it merely provided the public with an easement to the beach after plaintiff had acquiesced in public use of his beach. Only recently had private ownership become important. The court entered a judgment upholding the title of plaintiff. The only way plaintiff could have relinquished his title to the public was by dedication. However, in order to establish a dedication, the requisite subjective intent must be established by competent evidence. The fact that the beach had established a reputation in the community as 'public' was of no consequence. The title was vested in the plaintiff. (Stewart-Fla)
W69-07074

STATE V CALDWELL (SPECIAL ASSESSMENTS TO DEFRAY DRAINAGE COSTS).

35 So 2d 642-646 (Fla 1948).

Descriptors: *Florida, *Land reclamation, *Assessments, *Financing, Taxes, State governments, Legal aspects, Conservation, Land tenure, Land development, Judicial decisions, Legislation, Experimental farms, Agricultural engineering, Watersheds (Basins), Drainage engineering, Drainage programs.
Identifiers: *Conservancy districts, *Experiment stations, *Florida Internal Improvement Fund, Writ of mandamus.

A 1919 enactment of the Florida Legislature created the South Florida Conservancy District to reclaim land for settlement. The act also provided for a special assessment (acreage tax) on land within the district to finance improvements. An agricultural experiment station was created in 1921, and placed under the supervision of the Trustees of the Internal Improvement Fund. The station was declared to be subject to the assessments. The Trustees conveyed a section of their land to the State Board of Education while it was still used as part of the experiment station and refused to pay the assessments. The Legislature responded with an act making the Improvement Fund liable for all assessments on lands used by the experiment station. The district sought a writ of mandamus to compel payment. The Trustees attacked the validity of the act. The supreme court held that the writ should issue since the experiment station was benefitting from district projects. The court distinguished general taxes from special assessments, noting applicability of the latter under the circumstances regardless of a general tax exemption. (Harris-Fla)
W69-07075

UNITED STATES V WEAVER (REGULATING USE OF GOVERNMENT RESERVOIRS).

124 F Supp 517-525 (WD Ark 1954).

Descriptors: *Arkansas, *Federal government, *Reservoir operation, *Regulation, Reservoirs, Non-consumptive use, Recreation, Boats, Fishing,

emedies, Judicial decisions, Legal aspects, Administrative agencies, Permits, Recreation facilies, Marinas, Boating, Land use, Water utilization, Use rates.
dentifiers: Department of the Army.

Defendant kept and maintained boats for rental use n a nearby government reservoir. Congress had uthorized the Department of the Army to regulate he development and operation of recreational acilities on the reservoir. Plaintiff alleged that, in iolation of Department of the Army regulations, efendant, through his sons and others, had been nd was indirectly causing boats to be placed and perated on the reservoir for a fee or profit without uthority from the Department of the Army. Plainff sought to enjoin such actions. The court held hat defendant had no legal right to conducgmeeial operation on the waters of the reservoir unless uthorized to do so by the Department of the rmy. It enjoined defendant from either directly or ndirectly causing boats to be placed or operated n the reservoir for a fee or profit. However, the ourt noted that the Department of the Army had o control over the land on which defendant perated his business and, therefore, could not egulate such rentals. Nor did the Department have he right to determine that boats rented from deendant could not be used on the reservoir. Gabrielson-Fla)
W69-07076

OUNTY SEWER SURVEY COMMISSIONERS.

J Stat Ann secs 58:13-1 to 58:13-2 (1966), as mended, (Supp 1968).

Descriptors: *New Jersey, *Sewage disposal, Water pollution, *Planning, Political aspects, Administrative agencies, Financing, Expenditures, Water pollution sources, Legislation, Construction, Construction costs, Water pollution control, Legal spects, Cities, Maps, Maintenance, Sewage, Water ollution effects.

The commissioners are to consider the advisability f constructing a common sewerage system that ill convey the discharge of municipal disposal lants to a common destination with the objective f preventing stream pollution. They are empowered to make maps and plans, estimate costs, nd collect other information in relation thereto nd are directed to present to the legislature and reeholders a comprehensive plan for the laying ut, construction, and maintenance of such a ewerage system and disposal plant. (Holt-Fla)
W69-07077

CQUISITION OF LANDS AND WATER IGHTS FOR NEW OR ADDITIONAL WATER UPPLY.

J Stat Ann secs 58:6-1 to 58:6-5 (1966), as mended, (Supp 1968).

Descriptors: *New Jersey, *Water supply, *Cities, Condemnation, Water rights, Legislation, Legal spects, Water law, Eminent domain, Administrave decisions, Regulation, Water sources, Legal spects, Administrative agencies.

The act provides that any corporation or person ow or hereafter engaged in supplying municipalies with water has the power to acquire by gift, evise, or condemnation all lands and water rights ecessary for any new or additional water supply rovided such plans for diversion of water are approved and assented to by the state. Before the ght of condemnation is granted, approval must be btained from the State Water Policy Commission. ll proceedings commenced under the power of ondemnation are to be pursuant to eminent omain proceedings. This act by no way restricts he power to condemn lands, water, or water rights hich were enjoyed by corporations and persons upplying municipalities with water under any reviously existing law. (Holt-Fla)
W69-07078

GAITHER V ALBEMARLE HOSP (OBSTRUCTION TO NAVIGABLE STREAM AS A PUBLIC NUISANCE).
235 N C 431, 70 SE 2d 680-692 (1952).

Descriptors: *North Carolina, *Public rights, *Navigable waters, *Barriers, Breakwaters, Landfills, Relative rights, Rivers, Ownership of beds, Highways, Judicial decisions, Legal aspects, Real property, Streambeds, Land use, Land forming.
Identifiers: *Deep water line, *Injunctions (Prohibitory), *Public nuisance, Estoppel.

Plaintiffs and defendant purchased land from a common vendor. The land was bounded by a navigable river as shown on recorded maps and plats. Defendants sought to construct a breakwater along the deep water line and to fill up to the line in order to construct a public park. Plaintiffs contended that such action would deprive them of riparian rights, that defendant had no title to the beds of the river, and that defendant was estopped from altering the river by virtue of the recordation of the common vendor's maps and plats on which all buyers had relied in determining property boundaries. A referee made findings of fact and law consistent with plaintiffs' claim. The supreme court held it was settled that when an owner subdivides and records plats, he dedicates all public ways, as so platted, to the use of purchasers and the public. The river, as a navigable stream, constitutes such a public way. Any unreasonable, unauthorized obstruction of navigable waters is a public nuisance. It is sufficient to constitute such a nuisance if, as in this case, navigation is rendered less convenient. The fact that the obstruction may be of public benefit does not alter its character as a nuisance. An injunction was issued to prevent the construction of the breakwater and fill. (Harris-Fla)
W69-07079

UNITED STATES V PROPERTY ON PINTO ISLAND (TITLE TO RECLAIMED AND FILLED LANDS PREVIOUSLY SUBMERGED UNDER NAVIGABLE WATER).

74 F Supp 92-106 (S D Ala 1947).

Descriptors: *Landfills, *Ownership of beds, *Navigable waters, *Alabama, Land reclamation, Land tenure, Legal aspects, Riparian land, State governments, United States, Condemnation, Compensation, EMINENT DOMAIN, Public rights, Islands, Judicial decisions, Relative rights, Littoral, Federal government, Land forming, Boundaries (Property).
Identifiers: *Dredge spoil.

In a condemnation proceeding by the United States, three parties claimed title to land on Pinto Island, including a tract of reclaimed marshland and filled land which had been artificially created. The State of Alabama claimed title based on the fact that the lands had previously been the bed of a navigable water. The United States claimed title by virtue of a deed from the State of Alabama. One Turner claimed title based on the fact that the lands were an extension of a tract purchased by him. The fill was partially due to channel dredging and the deposit of spoil by the United States. The reclamation was accomplished by Turner. In determining who should be compensated for the condemnation of the land, the district court held that since the waters covering the submerged land were not navigable in fact, no title vested in Alabama. Therefore, no title passed from Alabama to the United States under the deed set up by the United States. The court held the privileges of a littoral owner included the right to fill out to navigable waters, regardless of who accomplished the filling. Such extension carries title with it, and thus Turner's claim of title prevailed. (Harris-Fla)
W69-07080

UNITED STATES V CAVALLIOTIS (OBSTRUCTING NAVIGATION).

105 F Supp 742-745 (E D N Y 1952).

Descriptors: *Federal jurisdiction, *Navigable waters, *Navigation, *New York, Ships, Judicial decisions, Legal aspects, Water law, United States, Nonnavigable waters, Legislation, Federal government, Streams.
Identifiers: *Obstruction to navigation, Penalties (Criminal).

Defendant was charged with violating a federal criminal statute which made it unlawful for anyone to obstruction navigation by means of a sunken vessel. Defendant's 22 foot wide ship sunk in the Steinway Creek while tied to a mooring and was permitted to remain in the 250 foot wide creek for over three years before an information was filed. The court held that the evidence adduced by the government failed to prove that the creek was navigable. The court said that the true test of navigability was susceptibility of use for transportation and not actual use. It was also found that defendant's ship was not sunk so as to impede navigation as a usable width of 228 feet still remained for vessels entering and leaving the creek. Since there was no obstruction to navigation, the defendant was found not guilty. (Holt-Fla)
W69-07081

PARKER V MOORE (LOSS OF NAVIGABILITY).

262 SW 2d 891-893 (Ark 1953).

Descriptors: *Arkansas, *Navigable waters, *Ownership of beds, *Nonnavigable waters, Transportation, Mineral industry, Oil, Natural gas, Leases, State governments, Judicial decisions, Rivers, Natural flow, Alteration of flow, Navigation, Navigable rivers, Lakes, Remedies, Highways, Streamflow, Beds under water.

Plaintiff brought this suit to have a lake adjacent to his property declared nonnavigable. Such a declaration would preclude the state's right to execute oil and gas leases for the land beneath the lake. The lake had once been part of a river and served as a means of transportation for many commercial ventures. However, over 100 years prior to commencement of this action, the natural course of the river changed drastically. This change isolated the present lake and rendered it nonnavigable. The court found that the lake was no longer a useful public mode of transportation. It no longer enjoyed its previous status as a navigable waterway. Since this was so, the judgement for the plaintiff was affirmed, and the defendant was found to have no right to grant mineral leases to the land beneath the lake. (Stewart-Fla)
W69-07082

DALRYMPLE V VILLAGE OF RANDOLPH (RETARDATION AND ALTERATION OF NATURAL FLOW).
275 App Div 743, 87 NYS 2d 742-743 (1949).

Descriptors: *New York, *Natural flow, *Alteration of flow, *Drainage water, Routing, Judicial decisions, Obstruction to flow, Natural flow doctrine, Streamflow, Surface runoff, Surface waters, Natural streams, Cities, Local governments, Gravels, Sediments, Retardants, Flow resistance, Remedies, Damages, Water levels, Drainage.
Identifiers: Injunctions (Mandatory).

Plaintiff brought this suit to recover for damage to his land allegedly caused by certain acts performed by defendant while trying to alter the natural course of a stream. These acts by the defendant caused large quantities of gravel to be deposited in the bed of a creek which drained the waters of the plaintiff's lands. The gravel retarded the natural flow. This caused a corresponding rise in the level of the water and prevented drainage. The court held the defendant liable for the damages. However, since the defendant restored both streams to their natural condition, the court refused to grant injunctive relief. (Stewart-Fla)
W69-07083

LIBRARY U. OF I., URBANA-CHAMPAIGN

REGIONAL DEVELOPMENT AND THE RURAL POOR,
Kentucky Univ., Lexington.
For primary bibliographic entry see Field 06B.
W69-07155

ECONOMIC ASPECTS OF WATER RESOURCE POLICY,
Wisconsin Univ., Milwaukee.
For primary bibliographic entry see Field 06B.
W69-07159

THE TVA TRIBUTARY DEVELOPMENT PROGRAM,
Arkansas Coll., Batesville.
For primary bibliographic entry see Field 06B.
W69-07183

INTERNATIONAL TRADE AND ITS EFFECT ON UNITED STATES FISHERIES,
For primary bibliographic entry see Field 06B.
W69-07193

CITIZENS COMM FOR HUDSON VALLEY V VOLPE (WAIVER OF THE DEFENSE OF SOVEREIGN IMMUNITY).
For primary bibliographic entry see Field 04C.
W69-07195

CITIZENS COMM FOR THE HUDSON VALLEY V VOLPE (PRELIM INJUNCTION BARRING HIGHWAY CONSTRUCTION ALONG A NAVIGABLE STREAM).
For primary bibliographic entry see Field 04C.
W69-07196

STEVENS V STATE MINERAL BOARD (REMOVAL OF CLOUD FROM TITLE TO SUBMERGED LANDS).

221 So 2d 645 (La Ct App 1969).

Descriptors: *Louisiana, *Ownership of beds, *Beds under water, *Real property, Prescriptive rights, Legislation, Oysters, Bays, Streams, Lakes, Lagoons, Channels, Coasts, Lake beds, Oil industry, Administrative agencies, State governments, Boundaries (Property), Streambeds, Riparian rights, Legal aspects, Tidal waters, Inlets (Waterways).

Plaintiff brought suit to remove clouds from title of certain tidal water beds on the east coast of Louisiana. The defendant contended that the plaintiff's title to the beds was defective in light of the oyster statute which provided that all beds of rivers, lagoons, bayous, bays, and sounds connected with the Gulf of Mexico were to remain the exclusive property of the state. The court noted that the effect of the oyster statute was to unequivocally retake title to underwater beds transferred by the state to state agencies. The plaintiff's predecessors in title had derived title from the State Levee Board which had received a patent to the beds from the state. The court held that the Levee Board had been divested of title by the oyster statute before its transfer to any other predecessor and the plaintiff's derivative title was therefore a nullity. The court carefully distinguished situations where the rights of third parties had intervened before passage of the oyster statute; in such situations, there would be no divestiture of vested property rights. Summary judgment was entered for the defendant since title had reverted to the state. (Katz-Fla)
W69-07197

ZONING, PLANNING AND HOUSING REGULATIONS.
Conn Gen Stat Ann secs 8-2 (Supp 1968).

Descriptors: *Connecticut, *Zoning, *Land use, *Regulation, Cities, Local governments, Sewerage systems, Flood control, Public rights, Public health, Administrative agencies, Legislation, Land tenure, Water supply.

The zoning commission of each city, town or borough is authorized to make extensive zoning regulations to protect public health and property values. Regulations shall be made according to a comprehensive plan to secure safety from fire, flood and other calamaties, and insure provisions for water, sewerage and other public requirements. (Harris-Fla)
W69-07198

DRY COMMENTS ON WATER,
For primary bibliographic entry see Field 05G.
W69-07199

UNITED STATES V HUGHES (FLOWAGE EASEMENT).
For primary bibliographic entry see Field 04A.
W69-07200

FEDERAL-STATE RELATIONSHIPS IN THE ADOPTION OF WATER QUALITY STANDARDS UNDER THE FEDERAL POLLUTION CONTROL ACT,
For primary bibliographic entry see Field 05G.
W69-07201

LOCAL SHELL FISHERIES.
Conn Gen Stat Ann secs 26-238 to 26-294 (1960), as amended, (Supp 1969).

Descriptors: *Connecticut, *Legislation, *Commercial shellfish, *Regulation, Fish management, Beds, Ownership of beds, Estuaries, Oysters, Clams, Mussels, Administrative agencies, Local governments, Permits, Tidal waters, Cultivation, Wildlife conservation, Fisheries, Bridges, Navigable waters, Streams, Boundaries (Property), Proprietary power, Legal aspects.

The selectmen of any town may appoint an oyster committee of not more than five electors of such town. The committee shall designate suitable places in the navigable waters within the jurisdiction of the town for planting or cultivating oysters, clams or mussels. Any individual desiring to cultivate oysters, clams, or mussels, may apply to the committee or to the authorized selectmen to designate a suitable place within the town's jurisdiction for that purpose. No such designation is effective until after a public hearing is held by the committee at which parties in interest and citizens may be heard. The applicant must provide the committee with a certificate from the town clerk stating that the ground has not previously been designated and is properly within the jurisdiction of the committee. Evidence of the committee's designation is to be recorded with the town clerk. The county court of common pleas may order lost and uncertain boundaries to be erected and established upon petition of an aggrieved party. This statute sets forth comprehensive prohibitions relating to the ways in which oysters may be taken. (Katz-Fla)
W69-07202

LOCAL SHELL FISHERIES.
Conn Gen Stat Ann secs 26-238 to 26-248 (1962), as amended, (Supp 1969).

Descriptors: *Connecticut, *Legislation, *Commercial shellfish, *Ownership of beds, Beds, Fish management, Estuaries, Oysters, Clams, Mussels, Administrative agencies, Local governments, Permits, Regulation, Tidal waters, Cultivation, Wildlife conservation, Fisheries, Bridges, Navigable waters, Streams, Boundaries (Property), Proprietary power, Legal aspects.

A designation by the committee shall consist of a written description of the ground by ranges or otherwise. All monies derived from such a designation shall be paid to the town. Any owner of ground previously designated and recorded by the town clerk may apply to have the ground redesignated to him should the evidence of that recording be lost. The court of common pleas for the appropriate county may appoint a committee of not more than three disinterested property owners to ascertain lost and uncertain boundaries. The court shall also entertain petitions from aggrieved parties seeking the return of natural beds to the public domain should such a bed be improperly granted. If such a bed has been improperly, but in good faith, staked-out, the court may grant the occupant a reasonable time to remove improvements and seeded oysters. (Katz-Fla)
W69-07203

LOCAL SHELL FISHERIES.
Conn Gen Stat Ann secs 26-249 to 26-251 (1960), as amended, (Supp 1969).

Descriptors: *Connecticut, *Legislation, *Commercial shellfish, *Ownership of beds, Fish management, Beds, Estuaries, Oysters, Clams, Mussels, Administrative agencies, Local governments, Permits, Regulation, Tidal waters, Cultivation, Wildlife conservation, Fisheries, Bridges, Navigable waters, Streams, Boundaries (Property), Proprietary power, Legal aspects.

Each person who cultivates oysters, clams, or mussels in a lawfully designated place shall own the oysters so seeded as well as all oysters naturally found there. Such person shall have the exclusive right to take up and dispose of such oysters, clams, or mussels. However, the rights of any owner of lands in which there may be salt water creeks or inlets, or which may be contiguous to navigable waters, shall not be affected by the forgoing. The committee is prohibited from enclosing any natural oyster or clam bed and from infringing upon the free navigation of such waters. Shellfish grounds not within exclusive jurisdiction shall be taxed by towns in the same manner and to the same extent as real property and no other tax will be levied on such a franchise. (Katz-Fla)
W69-07204

LOCAL SHELL FISHERIES.
Conn Gen Stat Ann secs 26-251 to 26-258 (1960), as amended, (Supp 1969).

Descriptors: *Connecticut, *Legislation, *Commercial shellfish, *Ownership of beds, Estuaries, Oysters, Clams, Mussels, Administrative agencies, Local governments, Permits, Regulation, Tidal waters, Cultivation, Wildlife conservation, Fisheries, Bridges, Navigable waters, Streams, Boundaries (Property), Proprietary power, Legal aspects.

Hard or round clams shall not be taken by a rake, tongs, or dredge unless such device has a space of more than one inch between its prongs. Clams less than one inch in thickness are not to be sold and are to be returned immediately to the water. Any person who trespasses upon designated ground shall be guilty of a misdemeanor. Any person who catches shellfish growing on or appurtenant to any bridge without written consent of the owner shall be fined. Plowing for shellfish is prohibited along Long Island Sound. Any person who injures the dams or gates of an oyster pond shall be fined. The superior county court, on application of the Oyster Committee, shall appoint three disinterested persons to ascertain, locate, and describe all the natural oyster, clam, or mussel beds within the boundaries of any town. These appointees will hold public meetings at which such determination shall be made. The findings made at such meetings shall be submitted to the court in the form of a report. (Katz-Fla)
W69-07205

LOCAL SHELL FISHERIES.
Conn Gen Stat Ann secs 26-259 to 26-294 (1960), as amended, (Supp 1969).

Descriptors: *Connecticut, *Legislation, *Commercial shellfish, *Ownership of beds, Fish management, Beds, Estuaries, Oysters, Clams, Mussels, Administrative agencies, Local governments, Permits, Regulation, Tidal waters, Cultivation, Wildlife conservation, Fisheries, Bridges, Navigable waters, Streams, Proprietary power, Legal aspects, Boundaries (Property).

Each town shall maintain accurate maps of its designated areas as well as of its natural clam, mussel, and oyster bars. These maps shall be placed on file with the town clerk's office. The remainder of this statute covers peculiar residual rules pertinent to the taking of shellfish in certain areas of the state. (Katz-Fla)
W69-07206

COMMERCIAL FISHERIES.
Conn Gen Stat Ann secs 26-142 to 26-186 (1960), as amended, (Supp 1969).

Descriptors: *Connecticut, *Legislation, *Fish, Commercial fishing, Commercial fish, Commercial shellfish, Fisheries, Fish management, Administrative agencies, Fish conservation, Permits, Regulation, Wildlife conservation, Nets, Fyke nets, Gill nets, Trawling, Trapping, Legal aspects.

The use of nets or devices in the inland waters of Connecticut is prohibited without registration with the board. Any person operating or tending a registered net or device must obtain a permit from the board. The statute sets forth a comprehensive list of fees charged for registration of nets. The required fee is determined on the basis of the type of net involved and the variety of fish to be taken with the net. The inland waters within which lawful nets may be used is determined by the board. The specifications and dimensions of such nets and commercial fishing gear, as well as the fishing seasons, are determined by the board. Every state licensee impliedly consents to inspection of his license and catch. All commercial fish hatcheries must be licensed by the state and are subject to periodic inspection. Fish preserves may charge a fee for taking fish from waters within their control and persons so engaged need not have a sport fishing license. All commercial fishing vessels must be registered withe board, and all persons operating or assisting on such vessels must be licensed by the state. (Katz-Fla)
W69-07207

COMMERCIAL FISHERIES.
Conn Gen Stat Ann secs 26-142 to 26-147 (1960), as amended, (Supp 1969).

Descriptors: *Connecticut, *Legislation, *Fish, Commercial fishing, Commercial fish, Commercial shellfish, Fisheries, Fish management, Administrative agencies, State governments, Fish conservation, Permits, Regulation, Wildlife conservation, Nets, Fyke nets, Gill nets, Trawling, Trapping, Legal aspects, Herrings, Eels.

All fyke, trap or pound nets are required to be buoyed and clearly marked with the license number of the owner in black numerals on a light background. All gill nets and seines shall have a metal registration tag attached. Tomcod and frost fish may be taken only by net constructed of twine or wire with mesh greater than three quarters of an inch and approved by the board. Smelt may be taken for commercial purposes only by registered nets, tended or operated by licensed persons. The board may extend the open season on smelt for as long as 7 days whenever adverse weather defers the smelt run. A permit is required to set an eel pot and any person using an eel pot must be licensed. No person shall take shad by using a net of less than 2 1/2 in. stretched mesh. The taking of shad is prohibited except during seasons determined by the board. During such seasons, shad may not be commercially taken on weekends. The taking of shad in any marine district is subject to the same regulations as in inland districts. (Katz-Fla)
W69-07208

COMMERCIAL FISHERIES.
Conn Gen Stat Ann secs 26-147 to 26-186 (1960), as amended, (Supp 1969).

Descriptors: *Connecticut, *Legislation, *Fish, *Commercial fishing, Commercial fish, Commercial shellfish, Fisheries, Fish management, Administrative agencies, State governments, Fish conservation, Permits, Regulation, Wildlife conservation, Nets, Fyke nets, Gill nets, Trawling, Trapping, Crabs, Lobsters, Fertilizers.

The board may permit any person to use a net for taking shad in the Connecticut and Farmington Rivers. Commercial hatcheries must be licensed and every license must be renewed annually. All commercial fishing vessels must be registered and crewmen must be licensed. Drag nets over thirty feet in length must be registered and their operators licensed. The bowl of any weir or other device must be constructed of net with a stretch mesh of at least two inches but this does not apply to fyke nets used for catching herring or bony fish. The board may designate certain areas of water in or near stream mouths or estuaries within which use of certain nets will be prohibited. No person is permitted to render any food fish into oil or fertilizer. Size limitations on crabs, lobsters and sturgeon offered for commercial purposes are to be strictly enforced. Each holder of a commercial fishing license must make an annual report disclosing the number and value of boats, nets, and devices used by him and the number, weight and value of the species of fish or lobsters caught by him. (Katz-Fla)
W69-07209

FEDERAL AID FOR RESTORATION PROJECTS.
Conn Gen Stat Ann, secs 26-14 to 26-17 (1960), as amended, (Supp 1969).

Descriptors: *Connecticut, *Legislation, *Administrative agencies, *Wildlife conservation, Fish conservation, Wetlands, Wildlife management, Permits, Habitat improvement, Federal government, United States, Fish establishment, Fish stocking, Legal aspects, Real property, Fisheries, Fish hatcheries, Regulation, Water resources development, Participating funds.
Identifiers: Federal-state relations.

Connecticut assents to Public Law 681 of the United States which offers aid to the states in fish restoration and management projects. The State Board of Fisheries and Game is directed to perform such acts as necessary to conduct and establish cooperative fish restoration projects, in accord with the guidelines set forth by the Secretary of the Interior. All funds accruing to the state from license fees paid by fishermen, hunters, and trappers shall be appropriated exclusively for the development of such fisheries The Board is authorized to acquire, by purchase, lease or otherwise, hunting and fishing rights on any land or water within the state. The Board shall determine the seasons during which these management lands shall be open and shall determine the bag limit permissible thereon. The Board may supply hunting facilities at a reasonable fee for use on these lands. The Board shall act in cooperation with the Department of Agriculture and Natural Resources in preserving and protecting the tidal wetlands of the state. (Katz-Fla)
W69-07210

FISHERIES AND GAME.

Conn Gen Stat Ann secs 26-6 to 26-7 (1960), as amended, (Supp 1969).

Descriptors: *Connecticut, *Legislation, *Wildlife conservation, *Administrative agencies, Fish conservation, Regulation, Permits, Local governments, Cities, State governments, United States, Fisheries, Parks, Legal aspects, Wildlife management, Animals.
Identifiers: Penalties (Criminal), Arrest.

State conservation officers appointed by the Director of the State Board of Fisheries and Game may arrest any person for violation of state game or fish laws without a warrant. Such officers may search or examine without warrant any container in which he has cause to believe illegally taken game is concealed. State conservation officers shall enforce federal wildlife regulations. The chief executive authority for any town may, with consent of the police chief, appoint special constables for fish and game protection. These special constables shall enforce only state and municipal game laws. The State Board of Fisheries and Game may appoint suitable citizens in each community to assist, as volunteers, without compensation, in any game program of the Board. (Katz-Fla)
W69-07211

IN RE APPROPRIATION OF EASEMENTS FOR HIGHWAY PURPOSES (COMPENSATION FOR DAMAGES CAUSED BY TAKING UNDER EMINENT DOMAIN).
For primary bibliographic entry see Field 04C.
W69-07212

INTERSTATE COMM'N ON THE POTOMAC RIVER BASIN.
For primary bibliographic entry see Field 05G.
W69-07213

STATE BOARD OF FISHERIES AND GAME GENERAL PROVISIONS.

Conn Gen Stat Ann secs 26-2 to 26-3a (1960), as amended, (Supp 1969).

Descriptors: *Connecticut, *Fish management, *Game management, *Conservation, Legal aspects, Legislation, Dams, Easements, State jurisdiction, Local governments, Natural resources, Fish hatcheries, Fishing, Hunting, Water policy, Land use, Resource development, Training, Maintenance, Operation and maintenance, Trapping, Regulation.
Identifiers: Penalties (Criminal), Penalties (Civil).

An appointed board of five members, serving without compensation, enforces all state laws relating to wildlife, fish, crustacea, game and nongame birds, water-fowl and game and fur-bearing animals. It has all powers necessary to carry out its duties and may bring actions in court to enforce laws promulgated by the board. Areas of responsibility include: (1) introduction, securing, and distribution of fish and game suitable for the state; (2) designation of closed fishing areas; and (3) taking of any animal for scientific purposes. The board has jurisdiction over all fish and game belonging to the state and may regulate hunting, fishing, and trapping on state land. The board may acquire land for establishment of fish hatcheries or game preserves. It may grant easements to the United States Government or any state subdivision with the approval of the attorney general. The board may construct and maintain rearing ponds for fish and may distribute these fish in state waters. It may destroy any undesirable or diseased species. It may enter into cooperative agreements to promote wildlife research and training with federal or local governments and private groups. It may acquire easements needed for maintenance of state owned dams. (Johnson-Fla)
W69-07214

DRIVING ON ICE.

Conn Gen Stat Ann sec 14-163a (1958).

Descriptors: *Connecticut, *Ice, *Bodies of water, *Regulation, Public rights, Legal aspects, Legislation, Freezing, Iced lakes.
Identifiers: *Motor vehicle regulation, *Penalties (Criminal), *Evidence.

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Driving a motor vehicle on the frozen surface of any public body of water shall be punishable by fine and, or, imprisonment. The presence of any motor vehicle on a frozen surface shall be prima facie evidence of a violation, except that this section shall not apply to governmental agencies or educational institutions. (Harris-Fla)
W69-07215

OBSTRUCTIONS.
For primary bibliographic entry see Field 04A.
W69-07216

RIGHT OF EMINENT DOMAIN.

W Va Code Ann sec 17-4-5 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Eminent domain, *Compensation, *Administrative agencies, State governments, Easements, Roads, Road construction, Bridges, Bridge construction, Interstate, Streams, Utilities, Decision making, Regulation.

The State Road Commissioner or the State Road Commission may acquire, by right of eminent domain, any land or water, or any interest therein, for purpose of constructing, widening, or otherwise altering any state road, or for purposes enumerated in section 17-4-25, or to provide a detour or temporary road or bridge while a road is in the process of construction, reconstruction, improvement, or repair, or for any other purposes authorized by any provision of this chapter. Whenever a just compensation cannot be agreed upon by the owner or claimant of such property, for such taking, use or damage, the State Road Commissioner, or the State Road Commission, are authorized to acquire, by eminent domain, any bridge or bridge site across any stream separating West Virginia from an adjoining state; such rights acquired may be acquired subject to use by any railroad or electric company. The State Road Commission may also exercise in any adjoining state such powers of eminent domain. Title to property condemned in any adjoining state may be taken either in the name of the state or of the State Road Commission. (Carruthers-Fla)
W69-07217

PERMITS AND POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W69-07218

POWERS, DUTIES AND SERVICES OF DIRECTOR OF THE DEPARTMENT OF NATURAL RESOURCES.
W Va Code Ann secs 20-1-7, 20-1-18 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Wildlife conservation, *Natural resources, Conservation, Land resources, Water resources development, Forest management, Forest fires, Camping, Hunting, Recreation, Fish hatcheries, Fish conservation, Natural gas, Oil, Gravels, Sands, Parks, Condemnation, Legal aspects, Legislation, Administrative agencies, Project planning, Research and development, Inspection, Surveys, State governments.

The Director of the Department of Natural Resources is responsible for preparation and administration of a comprehensive program for the conservation of natural resources. The Director may execute agreements in the name of the state, conduct research in improved conservation, investigate the habits of wildlife, and fix or suspend hunting seasons. The Director also has the authority to designate necessary localities for the perpetuation of any species of wildlife. The Director may enter private lands in order to conduct surveys and inspections and may make arrests to enforce the provisions of this act. The Director may purchase and acquire land for state forests, parks, and recreation areas, for public hunting, trapping and fishing grounds, and for fish hatcheries, game farms, wildlife research areas and feeding stations. The Director is further empowered to sell oil, gas, timber, minerals, sand, and gravel on state lands and is responsible for the protection of forests from fire. The Director will represent the interests of the state under provisions of applicable federal acts. The Director shall study the land and water boundary areas of the state for development, conservation, and use of water, forests, minerals, and wildlife. (Kelly-Fla)
W69-07219

SLACK-WATER DAMS (NATURAL RESOURCES ACT).
For primary bibliographic entry see Field 04A.
W69-07220

UNITED STATES V VIRGINIA ELECTRIC AND POWER CO (COMPENSATION FOR GOVERNMENT CONDEMNATION OF A FLOWAGE EASEMENT).
For primary bibliographic entry see Field 04A.
W69-07221

CONNECTICUT RIVER FLOOD CONTROL COMMISSION.
For primary bibliographic entry see Field 04A.
W69-07222

MUNICIPAL FLOOD AND EROSION CONTROL BOARDS.
For primary bibliographic entry see Field 04A.
W69-07223

STATE V LANZA (DELEGATION OF THE EMINENT DOMAIN POWER OF THE STATE).
27 N J 516, 143 A 2d 571-581 (1958).

Descriptors: *New Jersey, *Eminent domain, *Condemnation, *Legislation, Water resources development, Water supply, State governments, Relative rights, Land tenure, Damages, Administrative agencies, Public rights, Judicial decisions.
Identifiers: *Delegation of legislative power, *Constitutionality.

Pursuant to an enabling act, the New Jersey Commissioner of Conservation and Economic Development was authorized to acquire land in the Round Valley area for use in the future establishment of a water supply system. Acquisition was authorized by purchase or exercise of eminent domain. The State of New Jersey attempted to acquire defendant's land for public use, but no purchase price could be agreed upon. Defendant claimed that the enabling act was an unconstitutional declaration of power. On appeal from a judgment appointing commissioners to assess damages sustained by the taking, the Supreme Court held the legislature could constitutionally appropriate money to reimburse municipalities for lost tax revenues and relocation of roads. The court further held it constitutional for the legislature to delegate the power of eminent domain since although the power is exclusively legislative, the legislature cannot directly supervise each exercise of it. By defining the general, appropriate and necessary public need, and delegating acquisition of the land, the legislature had not demonstrated improper motive or arbitrary and capricious abuse necessary for judicial review. The decision was affirmed. (Harris-Fla)
W69-07224

CRIMES AND PENALTIES RELATING TO WATERS AND WATERCOURSES.

W Va Code Ann secs 61-3-25, 61-3-26, 61-3-28, 61-3-36, 61-3-47 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, Boats, Ships, Navigation, Navigable waters, Legislation, Dams, Fish management, Obstruction to flow, Railroads, Canals, State governments, Legal aspects, Buoys, Warning systems.
Identifiers: Navigation aids, Penalties (Criminal).

It is a felony, punishable by one to five years imprisonment, to cast loose any vessel with intent to injure or defraud the owner or insurer thereof or to tamper with the mooring of a vessel or floating material with intent to injure by letting such vessel become adrift. It is a misdemeanor, punishable by fine not exceeding $500 and/or imprisonment not exceeding 6 months, to tamper with any buoy or other navigation aid. It is a felony, punishable by at least one year's imprisonment, to obstruct, remove, or injure any part of a railroad or canal. It is a misdemeanor, punishable by fine of not more than $50 or imprisonment not more than 30 days, to anchor a shanty boat upon the real estate of another for more than twelve hours. Section 61-3-47 provides regulations for constructing dams in navigable streams and prohibits obstructing such streams by felling timber; violation is a misdemeanor punishable by fine not to exceed $1000 and/or imprisonment not to exceed one year. (Kahle-Fla)
W69-07225

STEPHENS V STEWART (VICARIOUS LIABILITY FOR NEGLIGENT MOTORBOAT OPERATION).

165 SE 2d 572-577 (Ga Ct App 1968).

Descriptors: *Georgia, *Boating, *Hazards, *Navigable waters, Legal aspects, Admiralty, Legislation, Administrative agencies, Federal government, State governments, Regulation, Judicial decisions, Recreation, Water sports, Swimming, Safety.
Identifiers: *Family purpose doctrine, *Vicarious liability, *Motorboat numbering act, *Civil liability, Retroactive legislation, Wrongful death action.

Plaintiff brought suit for wrongful death against the father of a 13 year old girl who struck and killed a 16 year old boy while operating a motorboat. The trial court entered judgment for plaintiff under the theory of respondiat superior. The court of appeals, in reversing the lower court, held that the act extending the 'family purpose' doctrine to watercraft was not retroactive, since it altered substantive rights, and did not apply to the case at hand. The court further held the power delegated to the Game and Fish Commission under the motorboat numbering act did not extend to a creation of civil liability for motorboat owners, even where the Legislature had approved the Commission's regulations. The court refused to consider a complaint based upon admiralty law and federal statutes dealing with watercraft operation on navigable waters, since the lake in question (Lake Lanier) had been held not to be navigable waters of the United States in a federal district court action. (Harris-Fla)
W69-07226

STATE V GILL (TITLE TO ARTIFICIAL ACCRETION).

66 So 2d 141-146 (Ala 1953).

Descriptors: *Alabama, *Riparian rights, *Landfills, *Accretion (Legal aspects), Littoral, Federal government, State governments, Riparian land, Remedies, Bays, Reclamation, Channels, Dredging, Channel improvement, Boundaries (Property), Shores, Navigation, Navigable waters, Ownership of beds, Judicial decisions, Legal aspects.

The federal government, while engaged in constructing a navigable channel, deposited some of the material dredged out of the channel along the shoreline of respondent's property, creating an artificial, manmade accretion. The state filed a bill to quiet title to the accreted land. Respondent answered, alleging that he possessed the title to the property and praying for general relief. The circuit

ourt held that title to the land was vested in espondent, and complainant appealed. The court, vhile making some procedural modifications, af-irmed the decision of the lower court. After ex-mining the relevant authorities, the court found hat the governing rule of law was that where accre-ion to the shore was caused by legitimate actions f the federal government, such accretion belonged o the littoral owner rather than the state. While the tate has title to the beds of navigable waters, this is itle to the beds as beds, not to the individual grains f sand or lumps of mud that constitute the land naking up the beds. Consequently, the state has no itle when the bottom is pumped up to create new and. The manmade land being added to the pro-erty of the riparian or littoral owner becomes the roperty of such owner. (Gabrielson-Fla)
V69-07227

DEPARTMENT OF HEALTH.
For primary bibliographic entry see Field 05G.
V69-07228

BRYANT V CHICAGO MILL AND LUMBER CO (TITLE TO ACCRETED LANDS).
16 F 2d 727-734 (8th Cir 1954).

Descriptors: *Arkansas, *Accretion (Legal spects), *Boundaries (Property), *Land tenure, udicial decisions, Water law, Federal jurisdiction, Riparian land, Chutes, Streams, Severance, Taxes, Remedies, Legal aspects, Real property.
Identifiers: Quiet title suit, Adverse possession.

Plaintiff brought this suit to quiet title to accreted nds held under a tax deed. Defendant cross-laimed to quiet title to the land in himself. The rial court granted judgment for defendant, and laintiff appealed. Both parties trace their title to a ommon owner. The accretions in question were ocated on the east side of a stream. By a tax deed, laintiff acquired title to land along the west side of he stream. Defendant claimed title to accreted nds along the stream under deeds purporting to onvey all land east of the stream. Defendant had lso paid taxes on the accreted lands for 15 years. laintiff based his claim on the general rule that a onveyance of riparian land carries with it all ccretions accumulated thereon. Defendant laimed that there was a severance of plaintiff's riginal riparian lands from the accreted lands in uestion. The court affirmed a judgment for the de-endant, basing their decision on the fact that de-endant's title purported to convey all land east of he stream. In addition, defendant had paid taxes or 15 years on the accreted lands, thus severing laintiff's riparian land from the accretions. The ourt noted that plaintiff was entitled only to the ccretions on the west side of the stream. (Holt-la)
V69-07229

CARROLL V HOPPE (RIGHT OF A RIPARIAN OWNER TO CONSTRUCT A JETTY).
For primary bibliographic entry see Field 04A.
V69-07230

LEONARD V STATE HIGHWAY DEPT REVESTING TITLE TO SUBMERGED LAND IN THE STATE).

4 N J Super 376, 94 A 2d 530-535 (1953).

Descriptors: *New Jersey, *State governments, Ownership of beds, *Land reclamation, Legal spects, Land tenure, Navigable waters, Dikes, Tidal waters, Low water mark, High water mark, Tidal effects, Beds, Administrative agencies, Riparian rights, Riparian land, Shores, Public ights, Legislation, Judicial decisions, Boundaries Property), Land development.
Identifiers: *Riparian grants, *State ownership.

Plaintiff's predecessor in title had constructed a ike along the bank of a stream in order to exclude tide waters from a portion of plaintiff's land. Plaintiff acquired title to the reclaimed lands through the previous title holder. Upon application by the State Highway Department, a riparian grant was issued to the state without notice to the plaintiff. Plaintiff sought to set aside the grant and to have a judgment of title in his favor. The superior court held that mere reclamation or improvement of land between the low and high water marks vested title in the shore owner under the state's 'Wharf Act.' The court further held that the repeal of the Act did not affect plaintiff's title. However, the court held that erosion along tidal waters extended the state's domain by natural means and revested title in the state. The dike no longer preserved plaintiff's title, and the grant to the State Highway Department was valid. The court felt that the state could retain its own title to land under water without notice to riparian owners. However, in dicta, the court said a grant to an individual must be subject to the preemptive rights of the riparian proprietor to have notice. A judgment was entered for the defendant. (Harris-Fla)
W69-07231

BRINDLEY V BOROUGH OF LAVALLETTE (VALIDITY OF CITY ORDINANCE REGULATING BEACH).

33 N J Super 344, 110 A 2d 157-168 (1954).

Descriptors: *New Jersey, *Legislation, *Boundaries (Property), Riparian land, Atlantic Ocean, Cities, Recreation, Easements, Public rights, Swimming, Beaches, Fishing, Legal aspects, Relative rights, Tidal waters, Surveys, High water mark, Low water mark, Judicial decisions.
Identifiers: *Pre-emptive rights, *Adverse user, Dedication, Due process (Substantive).

Beach front owners sued to test the validity of a city ordinance establishing a paid bathing beach which prohibited use by non-residents. Plaintiffs asserted that the city was not owner of the ocean front. Plaintiffs asserted that their properties abutted a street contiguous with the ocean front, and their titles extended to the high water mark, entitling them to riparian rights. Therefore, plaintiffs contended that the ordinance in question deprived them of their property rights. The court held the ordinance invalid as discriminatory against non-residents. The court observed that plaintiffs' deeds referred to a recorded map which described plaintiffs' lots together with intersecting streets, and, since this was so, the selling of the lots by plaintiffs' grantor amounted to a dedication of these streets. The court declared that plaintiffs owned to the center line of the street because the dedication was not formally accepted by the city nor impliedly accepted by public use. However, the street was subject to dedication when the city desired to accept it. The court stated that since the mean high water mark never reached the street's center line, plaintiffs were not littoral owners with a pre-emptive right to a riparian grant. The court held the ordinance valid, except for the discriminatory provisions, since a state statute authorized the city to regulate beaches acquired for recreational purposes. (Reed-Fla)
W69-07232

KENNEBEC TOWING CO V STATE (COLLISION WITH UNDERWATER OBSTRUCTION).
For primary bibliographic entry see Field 04A.
W69-07233

ANDERSON V DE VRIES (RIGHT OF WAY AND ACCESS OVER LAND TO A BEACH).

93 NE 2d 251-256 (Mass 1950).

Descriptors: *Massachusetts, *Right-of-way, *Beaches, *Access routes, Legal aspects, Land tenure, High water mark, Real property, Easements, Sea walls, Judicial decisions, Low water mark, Boundaries (Property), Roads, Swimming, Recreation facilities.
Identifiers: *Custom and usage.

Plaintiffs seek a determination of a right of way and a designation as to beach area available for their use as lot owners in the vicinity of the beach. Defendants owned land separating plaintiffs' lots from the beach and over which the alleged right of way extended. Plaintiffs' deeds provided, by means of a uniform clause, for a right of way to the beach, and prior to a conveyance to the defendants, it had been the custom of plaintiffs to use a 12 foot wide road to approach and make full use of the beach for sunbathing and swimming. Reviewing a decree by the Land Court, to which defendants filed exceptions, the Supreme Judicial Court held that defendants took no better title than their grantors, who had acquiesced in the use of the road and beach, and that although the right of way specified in the deed was indefinite, the one customarily used had implicitly replaced it. The Court held a 'beach' to be the land above the high water mark and defined by some natural or artificial sea wall or boundary which provides convenient and safe access to the water. Although not explicit in the deed, the court ruled the right of way included use of the entire beach--not merely an area equal to the width of the way. (Harris-Fla)
W69-07234

DAVIS V MORGAN (OWNERSHIP OF SUBMERGED LAND AND ACCRETION).

228 N C 78, 44 SE 2d 593-597 (1947).

Descriptors: *North Carolina, *Accretion (Legal aspects), *Land tenure, *Dredging, Legal aspects, Navigable waters, State governments, Legislation, Beds, Islands, Judicial decisions, Boundaries (Property), Real property.
Identifiers: *Jury instructions.

Plaintiffs brought action to establish title to certain property and to restrain defendant from trespassing thereon. Plaintiffs claimed title to land under an 1853 grant conveying land which was, at that time, either an island, a marsh or a shoal--partially submerged. Defendant contended that plaintiffs' grant was void as an attempt to convey land covered by navigable waters in violation of state law (G S 146-1). Defendant further claimed title to the land under a grant from the state in 1937. The superior court held for the plaintiffs. On appeal, the Supreme Court held that the following charge was not erroneous: 'Accretion is the increase of real estate by the gradual deposit by water of solid material...so as to cause that to become dry land which was before covered by water,...The doctrine of accretion does not apply to land reclaimed by man by filling in land once under water and making it dry.' The issue was whether accretion or dredging had caused additions to the tract in question. The court reversed the lower court on the basis of an erroneous exclusion of certain evidence and ordered a new trial. (Harris-Fla)
W69-07235

LOVIN V TOWN OF HAMLET (ATTRACTIVE NUISANCE DOCTRINE APPLIED TO ARTIFICIAL LAKE).
For primary bibliographic entry see Field 04A.
W69-07236

JONES V TURLINGTON (RIGHTS OF RIPARIAN OWNER TO ACCRETION).

243 NC 681, 92 SE 2d 75-77 (1956).

Descriptors: *North Carolina, *Riparian rights, *Maps, *Accretion (Legal aspects), Damages, High water mark, Inland waterways, Channels, Riparian land, Islands, Marshes, Navigable waters, Navigation, Wharves, Piers, Erosion, Legal aspects, Judicial decisions, Boundaries (Property), Beds.
Identifiers: *Deeds, Property description, Injunctions (Mandatory).

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Plaintiff brought suit for recovery of lands and damages for trespass to certain riparian lands which he claimed he was the owner. Defendant denied plaintiff's title to the land. Plaintiff had conveyed certain lands to the defendant. The lands as defined on the map included the riparian land. The plaintiff contended that he did not convey the riparian land since that land had been gradually built up through accretion. The court held that conveyance by the plaintiff, without reservation, vested ownership of land bordering on the waterway in the defendant with riparian rights incident to the ownership. The court held that the owner of riparian land acquires title to all extensions of his land by accretion and loses title to those lands that are washed or eroded away. The court held that the plaintiff had failed to show that title vested in him and granted judgment for defendant. (Shevin-Fla)
W69-07237

PASSAIC VALLEY SEWERAGE DISTRICT.
For primary bibliographic entry see Field 05G.
W69-07238

CITY OF TACOMA V TAXPAYERS OF TACOMA (STATE COURTS PRECLUDED FROM CONSIDERING ISSUES DECIDED BY FEDERAL COURTS).

357 U S 320-342 (1958).

Descriptors: *Federal government, *Federal Power Act, *Federal jurisdiction, *Federal-state water rights conflicts, Legal aspects, Water rights, Hydroelectric project licensing, Cities, State jurisdiction, State governments, Navigable rivers, Pondage, Water resources, Hydroelectric plants, Dams, Stream fisheries, Electric powerplants.
Identifiers: United States Supreme Court, Delegation doctrine, Due process, Commerce power.

Plaintiff city was granted a license by the Federal Power Commission, over objections of the State Attorney General, to construct a series of power dams over navigable rivers. Some of these dams were to be built on state-owned lands, and one would cause inundation of a state fish hatchery. The state appealed the Commission's order to the Federal Circuit Court of Appeals which upheld the order. The city brought suit, under the license, to obtain a state superior court order allowing the city to issue revenue bonds to finance the project. The state intervened asserting the same grounds that had been rejected by the Power Commission and the federal court. The state superior court ruled in favor of the state, and the state supreme court affirmed. The city obtained certiorari to the U S Supreme Court which reversed the decision of the state courts. The state's contention that the city could not exercise federal eminent domain power to take state property was rejected. The city's license and right to take the state lands in question were a valid delegation of the Federal Power Commission's exclusive dominion over the navigable waters of the United States. The state's ability to appeal Power Commission orders unfavorable to it has been prescribed by federal statute. The federal court of appeals' decision favoring the Commission was final under federal law, and the state could not, in a later state court action, question the city's power to take state lands under its federal license. (Blunt-Fla)
W69-07239

UNITED STATES V FEDERAL POWER COMMISSION (FEDERAL POWER COMMISSION AUTHORITY OVER PROJECT LICENSING).
For primary bibliographic entry see Field 04A.
W69-07240

DYE V UNITED STATES (WRONGFUL DEATH ACTION FOR NEGLIGENCE IN DAM MAINTENANCE).

210 F 2d 123-129 (6th Cir 1954).

Descriptors: *United States, *Warning systems, *Accidents, *Dams, Boating, Kentucky, Administrative agencies, Federal government, Judicial decisions, Legal aspects, Ohio River, Control structures, Dam design, Engineering structures, Damages, Navigable rivers, Navigable waters, Operation and maintenance, Flow augmentation, Regulation.
Identifiers: *Negligence, Corps of Engineers, Coast Guard, Wickets.

Plaintiffs brought these wrongful death actions against the defendant as a result of drownings which occurred when two small boats were pulled over a dam by the force created when the dam's wickets were left open. Plaintiffs alleged negligence on the part of the Coast Guard and the Corps of Engineers in permitting the wickets of the Ohio River Dam to be open without adequate warning and without suitable protection for river travelers. The dam was owned by the United States, and the Corps of Engineers was responsible for its maintenance and operation. Upon hearing evidence which included testimony that two signs warning of the dangerous condition were prominently displayed, the trial court dismissed the complaints. The appellate court reversed, directed verdicts for plaintiffs, and remanded for a determination of damages. The court held that the evidence was sufficient to establish negligence by the dam operator in failing to give adequate warning of a dangerous condition and failure of the Government to use protective measures for the benefit of navigators. The court noted that the area Coast Guard observer failed to warn boats after being instructed as to when the wickets would be lowered. (Wheeler-Fla)
W69-07241

UNITED STATES V GENERAL BOX CO (CONDEMNATION OF LAND FOR LEVEE PURPOSES).
For primary bibliographic entry see Field 04A.
W69-07242

GENERAL BOX CO V UNITED STATES (RECOVERABLE DAMAGES FROM LEVEE CONSTRUCTION).
For primary bibliographic entry see Field 04A.
W69-07243

CENTRAL NEW YORK BROADCASTING CORP V STATE (SUIT TO RECOVER DAMAGES FOR NEGLIGENCE OF STATE IN FLOOD CONTROL PROJECT).
For primary bibliographic entry see Field 04A.
W69-07244

PERKINS V PALO ALTO COUNTY (SUIT FOR INJUNCTION REQUIRING COUNTY TO CONSTRUCT A CULVERT).
For primary bibliographic entry see Field 04A.
W69-07245

UNITED STATES V DICKINSON (SUIT TO RECOVER VALUE OF LAND FLOODED BY THE FEDERAL GOVERNMENT).
For primary bibliographic entry see Field 04A.
W69-07246

TOOMER V WITSELL (CONSTITUTIONALITY OF STATE REGULATION OF SHRIMPING IN 3 MILE MARITIME BELT).

334 U S 385-410 (1948).

Descriptors: *Commercial fishing, *Regulation, *Shrimp, *State governments, Legal aspects, South Carolina, Legislation, Permits, Taxes, Relative rights, Fish migration, State jurisdiction, Judicial decisions, Fish management, Fish conservation, Fish harvest.
Identifiers: *Maritime belt, *Constitutionality, *Injunctions (Prohibitory), Privileges and immunities clause, Police power, Commerce clause.

Fishermen (residents of Georgia) sought to enjoin enforcement of South Carolina statutes governing commerical shrimping for migratory shrimp within the 3 mile maritime belt off the coast of South Carolina. The district court refused to issue the injunction. The Supreme Court held that the state had sufficient interest in preserving the natural resources of the state to sustain the regulation of shrimping in the maritime belt as a reasonable exercise of the state's police power. The court upheld a tax on shrimping but found two exercises of the power unconstitutional. An imposition of license fees 100 times greater for non-residents than for residents was violative of the privileges and immunities clause since the state could not justify the discrimination as necessary for conservation of shrimp. The Court denied the state 'owned' the shrimp, since they were migratory. A statute requiring unloading, packing, and tax stamping of all shrimp caught in the maritime belt to be done in South Carolina ports was held violative of the commerce clause. The Court held that the state could prohibit shrimping completely; however, if it chose not to do so, it could not excessively burden interstate commerce by imposing rigid economic patterns after such shrimping occurred. (Harris-Fla)
W69-07247

GOODYEAR TIRE AND RUBBER CO OF ALABAMA, INC V GADSDEN SAND AND GRAVEL CO, INC (UNDERSEEPAGE AND WATER FLOWAGE).
For primary bibliographic entry see Field 04A.
W69-07248

BURLEYSON V WESTERN AND ATLANTIC RR (OVERFLOW AS AN ABATABLE NUISANCE).
For primary bibliographic entry see Field 04A.
W69-07249

PERSIN V CITY OF YOUNGSTOWN (FLOODING OF LOWER TRACT DUE TO AIRPORT CONSTRUCTION).
For primary bibliographic entry see Field 04C.
W69-07250

GOUGH V GOBLE (OBSTRUCTION TO FLOW OF SURFACE WATER).
For primary bibliographic entry see Field 04A.
W69-07251

STATE V GEORGE C STAFFORD AND SONS (BOUNDARY DISPUTE OVER FILLED IN LAKE SHORE).
For primary bibliographic entry see Field 04A.
W69-07252

TEXAS CO V MONTGOMERY (POLLUTION CONTROL BY STATE AGENCIES).
For primary bibliographic entry see Field 05G.
W69-07253

FLANAGAN V GREGORY AND POOLE INC (UPSTREAM RIGHTS IN RE FLOW).
For primary bibliographic entry see Field 04C.
W69-07254

COUSIN V HORNSBY (LANDOWNER IS RESTRICTED TO ACTION FOR DAMAGES ONCE RIGHT TO RESIST EXPROPRIATION IS WAIVED).
For primary bibliographic entry see Field 04C.
W69-07255

BUILD PIER AS MEMORIAL TO SAILORS AND SOLDIERS.

N J Stat Ann secs 40:179-106 through 40:179-108 (1967), as amended, (Supp 1968).

Descriptors: *New Jersey, *Piers, *Recreation facilities, *Parks, Social aspects, Seashores, Ownership of beds, Oceans, Coasts, Littoral, Atlantic Ocean, Piles (Foundations), State jurisdiction, Public benefits, Legislation, Public lands, Tidal waters, Financing.
Identifiers: Notice, Due process.

This statute, passed in 1924, allows any oceanside city to make permanent use of the state's tidewater lands for the purpose of constructing a 'victory pier' in memory of the nation's soldiers and sailors. The pier must be a part of an area set aside for a public resort or as a public park. Such pier may be paid for under any reasonable method the common council of the city, with the assent of the public, may choose. The piers may not extend more than 3,000 feet outward from the oceanside boundary line of the public area, and such piers shall be considered part of the public area. The statute establishes notice requirements which must be followed in the event the common council of any city intends to pass an ordinance authorizing a 'victory pier.' All parties interested in such an ordinance must be given an opportunity to be heard. (Blunt-Fla)
W69-07256

FISH AND GAME LAWS--FISHWAYS IN DAMS.

N J Stat Ann secs 23:9-94 to 23:9-97 (1940).

Descriptors: *Dams, *Fish passages, *Fish management, *Construction costs, Administrative agencies, State governments, New Jersey, Legislation, Rivers, Regulation, Financing.
Identifiers: Raritan river.

The Fish and Game Board is hereby empowered to examine all dams spanning the Raritan River and its tributaries to ascertain whether such dams have good and efficient fishways constructed in them. The Board has the power to order the party in possession of a dam to build, rebuild, or remodel inefficient fishways. The Board must give each individual sixty days from receipt of notice to complete the required work. If the work ordered is not done, the Board may cause it to be done at the expense of the individual and may bring action in a court of law to recover the costs incurred in performing the work. (Blunt-Fla)
W69-07257

RIVER DEVELOPMENT CORP V LIBERTY CORP (LAPSE OF OPTION TO IMPROVE OFFSHORE LANDS THROUGH INACTION ON THE PART OF THE GRANTEE).

45 N J Super 445, 133 A 2d 373-379 (1957).

Descriptors: *New Jersey, *Grants, *State governments, *Ownership of beds, Judicial decisions, Permits, Legislation, Legal aspects, Water law, Beds, Beds under water, Dredging, Excavation.
Identifiers: Options.

Plaintiff sought a judicial declaration of his rights in certain offshore tidal lands. The plaintiff calimed title under an 1869 statute, the United Companies Act, which authorized the plaintiff's predecessor in title to fill the lands in question. The plaintiff bought the lands from its predecessor in 1955. Neither the plaintiff nor its predecessors ever made any attempt to improve the lands as stipulated. The defendant denied that the 1869 act conveyed anything more than a revocable license which the state impliedly revoked by granting the defendant's license to dredge in the area. This court held that guardianship of tide-flowed lands below the high water line is in the legislature and therefore is subject, by statute, to an express grant of a freehold, or any lessor, estate, to any grantee, regardless of whether he is the owner of the lands above the high water mark or not. The 1869 act created a revocable license in the plaintiff's predecessor, a mere personal privilege which was revocable at law, at the licensor's pleasure, even though substantial sums had been paid in consideration of the license. When no time is fixed for performance under a contract or option, a reasonable period is intended, and where there has been no performance for 88 years, such option becomes unenforceable and the holder may lose his inchoate right to the land. (Blunt-Fla)
W69-07258

NORTH COUNTIES HYDRO-ELECTRIC CO V UNITED STATES (HYDRO-ELECTRIC PLANTS).

151 F Supp 322-324 (Ct Cl 1957).

Descriptors: *Illinois, *Hydroelectric plants, *Flood damage, *Ice jams, Flood protection, Flood forecasting, Flood control, Ice, Ice breakup, Dams, Dam design, Power plants, Legal aspects, Reservoirs, Reservoir storage, Rivers, Judicial decisions.

Plaintiff owned and operated a hydro-electric power plant on the Fox River in Illinois. He brought suit against the United States for an alleged taking of his plant. Plaintiff had brought an identical suit against the United States 10 years earlier. In both cases, plaintiff's theory was that the United States, by erecting a dam on the Illinois River, created a condition which caused large ice jams to form below plaintiff's dam. This condition so impeded the flow of the Fox River as to cause flooding of plaintiff's power house, thereby halting its operation. The United States interposed the defense of res adjudicata. The court sustained this defense, holding that every element of plaintiff's cause of action had been finally adjudicated in the earlier proceedings between the parties. (Carruthers-Fla)
W69-07259

STUART V LAKE WASHINGTON REALTY CORP (ACTION TO ENJOIN FLOODING OF PROPERTY BY RAISING LAKE LEVEL).
For primary bibliographic entry see Field 04A.
W69-07260

FEIG V GRAVES (PLAINTIFF CLAIMS IMPLIED EASEMENT TO SHORE OF RECEDING LAKE).
100 So 2d 192-196 (2d DCA Fla 1958).

Descriptors: *Florida, *Easements, *Riparian rights, *Accretion (Legal aspects), Judicial decisions, Water law, Boundary disputes, Relative rights, Boundaries (Property), Lakes, Ownership of beds, Scenic easements, Easements, Legal aspects.
Identifiers: Implied easements, Injunctions (Prohibitory).

Plaintiffs requested a declaratory judgment regarding their rights in respect to land and waters adjacent to a lake owned by defendants. A plat map of the area in question showed that plaintiffs' rest home originally was separated from the lake only by a walkway circling the lake. The lake had receded in recent years, however, leaving the edge of the path between 70 and 80 feet from the lake. Plaintiffs asserted that they retained an implied easement for use of the land adjoining the lake, although the walkway was some distance from the water. The court found that the original subdividor of the property had intended that plaintiffs retain use of the land adjoining the lake, and that this easement extended to the present lake margin. In Florida the margin of a body of water constituting a boundary generally continues to be the boundary regardless of reliction or erosion. Since the defendants owned the lake bed, plaintiffs gained no rights in fee to the land between the old and new lake margins; plaintiffs' easement, however, extended to the new location of the lake margin. (E Kelly-Fla)
W69-07261

ORTEGO V CALDWELL (ACTION FOR DAMAGES DUE TO CROP FLOODING RESULTING FROM DEFECTIVE LEVEE).
For primary bibliographic entry see Field 04C.
W69-07262

GINTHER V LONG (ACTION FOR DAMAGES DUE TO TEMPORARY POLLUTION OF SOIL, RESULTING IN TIMBER LOSS).
For primary bibliographic entry see Field 04C.
W69-07263

6F. Nonstructural Alternatives

FLOOD COVERAGE: NEW CHALLENGE FOR INSURANCE.
For primary bibliographic entry see Field 04A.
W69-06898

INDUSTRIAL FLOOD LOSSES: DAMAGE ESTIMATION IN THE LEHIGH VALLEY,
Chicago Univ., Ill.
For primary bibliographic entry see Field 06B.
W69-07174

07. RESOURCES DATA

7B. Data Acquisition

SIPHON METHOD FOR MEASURING WATER LEVELS,
Geological Survey, Phoenix, Ariz. Water Resources Div.; and Agricultural Research Service, Chickasha, Okla. Soil and Water Conservation Research Div.
Coyd Yost, Jr. and James Nancy.
J Amer Water Works Ass, Vol 61, No 6, pp 314-316, June 1969. 3 p, 1 fig, 3 ref.

Descriptors: *Gaging stations, *Reservoirs, *Siphons, Pipelines, Tubes, Water measurement, Instrumentation, Reservoir stages, Water levels.
Identifiers: Reservoir gages.

The use of siphons for measuring reservoir water levels is discussed. If a gage in the reservoir or a tube to lead water through the dam to a remote gate is impractical, a siphon may be used to lead water over the dam, if the altitude difference between the water surface and siphon summit is not too great. Experience in designing and using the siphon method indicates that it is practical and generally applicable for measuring water levels in lakes, canals, streams, wells, and other open water bodies. Under certain field conditions the method is distinctly preferable to other methods. The characteristics that particularly contribute to the usefulness of the siphon method concern its accuracy and the fact that its installation, maintenance, and operation are simple and economical. For special applications the siphon may be designed as a light-weight portable unit and installed with hand tools. Absence of any horizontal inlet precludes difficulties in installation or structural damage to the canal, dam, or stream bank. The well and recorder may be remotely located at a convenient site relatively far from the water body. (USGS)
W69-07086

DESIGN AND PERFORMANCE OF AN OSMOTIC TENSIOMETER FOR MEASURING CAPILLARY POTENTIAL,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
A. J. Peck, and R. M. Rabbidge.
Soil Sci Soc Amer Proc, Vol 33, No 2, pp 196-202, Mar-Apr 1969. 7 p, 11 fig, 9 ref.

Descriptors: *Tensiometers, *Osmotic pressure, *Soil water, Soil moisture, Soil chemistry, Osmosis, Capillary action, Capillary water, Pore pressure, Moisture tension.

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Identifiers: *Osmotic tensiometer, Capillary potential.

An osmotic tensiometer makes use of a confined aqueous solution, instead of pure free water, as the reference state in measuring soil-water potentials. The membrane separating the confined solution from soil water is highly impermeable to the confined solute (polyethylene glycol, molecular weight 20,000), but exchange of much smaller molecules and ions occurs. Thus the capillary potential of soil-water is measured unless soil solutes are excluded from the instrument by a vapour gap. The advantage of this instrument over conventional tensiometers is that measurements of capillary potential can be made throughout the range 0 to minus 15 bar. Tests and observations show that osmotic tensiometers can be useful for measurements of capillary potential at depths greater than about 10 cm during the redistribution of soil water, and its uptake by plants. For accurate data, zero checks should be made when possible, and instrument temperature should be recorded to enable correction for its effect on each reading.
W69-07090

AERIAL PHOTOGRAPHIC TECHNIQUES IN POLLUTION DETECTION,
Wisconsin Univ., Madison. Dept. of Civil Engineering; and Itek Corp., Lexington, Mass. Photogrammetry Dept.
For primary bibliographic entry see Field 05A.
W69-07111

DYNAMIC MEASUREMENT OF THE HYDROLOGIC CHARACTERISTICS OF UNSATURATED POROUS MATERIALS,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 02G.
W69-07152

7C. Evaluation, Processing and Publication

CHARACTERIZATION OF BRINES FOR ECONOMIC ANALYSIS,
Dow Chemical Co., Freeport, Tex.
For primary bibliographic entry see Field 03A.
W69-06951

SUBSURFACE BRINES AND MINERAL EQUILIBRIA,
McMaster Univ., Hamilton (Ontario). Dept. of Geology.
For primary bibliographic entry see Field 02K.
W69-06952

A SPECIAL CASE, THERMAL DIGITAL SIMULATION OF WASTE HEAT DISCHARGES,
Battelle Memorial Inst., Richland, Wash.; and Computer Sciences Corp., Richland, Wash.
For primary bibliographic entry see Field 05C.
W69-06979

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Office of Water Resources Research, Washington, D. C.
Roland R. Renne, and Glen D. Fulcher.
Land and Water L Rev, Vol 4, No 1, pp 145-158, 1969. 14 p, 12 ref.

Descriptors: *Water resources research act, *Water law, *Institutions, Legislation, Allotments, Universities, Water rights, Research facilities, Water resources development, Programs, Projects, Legal aspects, Future planning (Projected), Long term planning, Administration.

The Water Resources Research Act of 1964 established an Office of Water Resources Research and authorizes various institutions, firms, and agencies to carry out water research. The purpose of the research programs is to supplement and strengthen the total national water research effort. There are 4201 recorded projects underway, of which 3016 are federally supported and 735 are established under the 1964 Act. The research is grouped under 9 categories and 44 subcategories. Water law research is grouped under the Water Resources Planning category and is a study of water law looking toward changes to improve use efficiency and investigation of institutional structures influencing decisions on water. The content of legal research is divided generally among legal aspects, legislation, water rights, and water law. 3 tables show: (1) distribution of legal research by category; (2) the disciplines involved in water law research; (3) the organizations supporting legal research. Among the benefits from legal research are books and legislation. Promising research areas include: regional water development, weather modification, ground water pollution, thermal pollution, water rights and integration of surface and ground water use. The author concludes that future legal research should be oriented toward a more comprehensive approach, calling for interdisciplinary and interregional research. (Helwig-Fla)
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e of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

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- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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01 NATURE OF WATER
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03 WATER SUPPLY AUGMENTATION AND CONSERVATION
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04 WATER QUANTITY MANAGEMENT AND CONTROL
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05 WATER QUALITY MANAGEMENT AND PROTECTION
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06 WATER RESOURCES PLANNING
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07 RESOURCES DATA
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08 ENGINEERING WORKS
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09 MANPOWER, GRANTS, AND FACILITIES
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10 SCIENTIFIC AND TECHNICAL INFORMATION
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AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

NATURE OF WATER

Properties

TRANSPORT OF ENERGY BY INTERNAL ES,
nal Center for Atmospheric Research, der, Colo.
r L. Jones.
s, Vol 21, No 2, pp 177-184, 1969. 8 p, 1 fig, f.

iptors: *Mathematical studies, *Energy fer, *Internal water, *Waves (Water), Turbu-, Analysis, Density, Advection, Heat flow, s law, Thermodynamics, Stress, Friction, r structure.
ifiers. Internal wave energy transport.

different concepts of energy transport by s are developed and compared. The 'wave y flux' is related to the transport of a quantity n as the wave energy, and has often been used alyzing the characteristics of the waves them-. The 'correlation wave energy flux' is related transport of energy by a phenomenon called ve, is analogous to turbulence energy trans- and is of use in total system energy budgets. sipative fluids and fluids with spatially varying flows, the two are not the same. In the course analysis, a comparison is made between the s expansion commonly used in linear wave y and the mean and deviation approach of tur-ce. (Gabriel-USGS)
07502

WATER CYCLE

General

EOROLOGICAL CAUSES FOR THE AU- FLOODS BETWEEN 1950 AND 1960 NCH),
rimary bibliographic entry see Field 02E.
07367

SSENTIAL FACTOR IN THE NATURAL ER CYCLE: THE RATE OF CIRCULA- IN PERMEABLE GROUNDS (FRENCH),
ourg Univ. (France). Lab. of Fluid anics.
rimary bibliographic entry see Field 02F.
07391

FACE-RUNOFF MODEL DEVELOPED BY LYTICAL METHODS,
essee Valley Authority, Knoxville.
r P. Betson, Russell L. Tucker, and Faye M. r.
r Resources Research, Vol 5, No 1, pp 103-February 1969. 9 p, 5 fig, 2 tab, 5 ref.

iptors: *Mathematical models, *Analytical iques, Optimization, Surface runoff, Compu-Hydrology.

ng analytical methods, successive restrictions imposed on a mathematical version of the U. Weather Bureau's graphical surface-runoff l to develop an analytical model that ex-s the API-runoff relations with two equations ive coefficients. The analytical model is r in concept to the graphical model in that relate rainfall, week number, and the API ire to surface runoff. The concise relations of nalytical model, however, can be rapidly d from a historical storm list by computer. tested, runoff relations, derived with the ical model over selected watersheds, pre- surface runoff from those watersheds what better than the regional, graphical rela- leveloped for the Valley.
07464

SOME NOTES ON THE RATIONAL METHOD OF STORM DRAIN DESIGN,
American Society of Civil Engineers, Cambridge, Mass. Engineering Sciences Lab.
M. B. McPherson.
ASCE Urban Water Resources Res Prog Tech Mem No 6, Jan 22, 1969. 84 p, 9 fig, 3 tab, 42 ref, 2 append. USGS Contract No. 14-08-0001-11257. Available from Clearinghouse as PB 184 701 at $3.00 in paper copy and $0.65 in microfiche.

Descriptors: *Urbanization, *Storm drains, *Rainfall-runoff relationships, *Rational formula, *Storm runoff, *Design, Drainage systems, Surface runoff, Routing, Hydrographs, Runoff, Hydraulic design, Design flood, Systems analysis, Stream gages, Gaging stations, Coefficient.
Identifiers: Storm drainage design.

Because the 'rational method' of designing urban storm-drainage facilities has substantial liabilities, new design procedures are discussed and the urgent need for more field stream-gaging data is stressed. The limitations of the rational method consist mainly of the weaknesses of projecting standard values of the rainfall-runoff relationship over wide geographical areas, the use of too many standardized assumptions, and using the same runoff routing methods in too many dissimilar situations. Suggested improved design methods would use on-site gaged rainfall-runoff relations to determine flow probabilities in mathematical models so that the optimum drainage system for each particular case may be designed. Presently there are no gaging programs of sufficient scope in operation. Other suggestions include the use of surface detention to flatten runoff peaks, storage of urban runoff for water-supply use, or use of urban runoff as a source of recreational water. (Knapp-USGS)
W69-07482

AVAILABILITY OF RAINFALL-RUNOFF DATA FOR SEWERED DRAINAGE CATCHMENTS,
American Society of Civil Engineers, Cambridge, Mass.
L. S. Tucker.
ASCE Urban Water Resources Res Program Tech Mem No 8, Mar 3, 1969. 43 p, 14 fig, 5 tab, 18 ref, 1 append. USGS Contract No 14-08-0001-11257, OWRR Contract No 14-01-0001-1585. Available from Clearinghouse as PB 184 703 at $3.00 in paper copy and $0.65 in microfiche.

Descriptors: *Data collections, *Gaging stations, *Cities, *Rainfall-runoff relationships, *Urbanization, Drainage systems, Runoff, Storm drains, Sewers, Storm runoff, Flow rates.
Identifiers: Urban runoff gaging, United States.

Data on the availability of rainfall-runoff data from gaged, sewered urban catchments are compiled. Only 13 completely sewered catchments in the U. S. are gaged. Runoff is measured by flume in Northwood, Gray Haven, and Swansea, all in Baltimore, Md. Reduced data from 29 Gray Haven Storms are tabulated. The 13 catchments are summarized in a table giving name, size, data collected, type of flowmeter, type of storm sewer, data available, operator of the installation, location, and period of operation. Each installation and catchment is described in detail. Baltimore has 3 gaged catchments, Cincinnatti, Ohio has 1, St. Louis, Mo. has 3, Chicago, Ill. has 1, Philadelphia, Pa. has 1, New York City has 4, and Washington D. C. has 1. (Knapp-USGS)
W69-07484

RAINGAGE NETWORKS IN THE LARGEST CITIES,
American Society of Civil Engineers, Cambridge, Mass. Engineering Sciences Lab.
For primary bibliographic entry see Field 02B.
W69-07485

SEWERED DRAINAGE CATCHMENTS IN MAJOR CITIES,
American Society of Civil Engineers, Cambridge, Mass. Engineering Sciences Lab.
L. S. Tucker.
ASCE Urban Water Resources Res Program Tech Mem No 10, Mar 31, 1969. 71 p, 34 fig, 4 tab, 13 ref. USGS Contract No. 14-08-0001-11257. Available from Clearinghouse as PB 184 705 at $3.00 in paper copy and $0.65 in microfiche.

Descriptors: *Cities, *Rainfall-runoff relationships, *Storm drains, *Sewers, Storm runoff, Drainage systems, Water quality control, Water pollution control.
Identifiers: Urban rainfall-runoff-water quality relationships, Combined sewer systems.

The size distribution and number of sewered drainage catchments in San Francisco, Washington, D. C., Milwaukee, Houston, and Philadelphia are summarized to provide data for urban rainfall-runoff-water quality studies. The 4 cities are in 4 distinctly different regions of the US, and are different topographically. The sizes of all sewered drainage catchments are tabulated, maps show catchment boundaries, and supporting discussions are presented. Only the drainage catchments served entirely by storm or combined sewers are discussed, and partially sewered urban drainage catchments are omitted. The distribution of sewered drainage catchment size is unique for each city. The number of catchments varies from 42 in San Francisco to 1,283 in Houston. The largest catchment varies from 1,820 acres in Milwaukee to 6,180 acres in Washington, D. C. The average catchement size varies from 65 acres in Houston to 560 acres in San Francisco. The median catchment size varies from 6 acres in Houston to 190 acres in San Francisco. In Washington, D. C., drainage catchments varying in size from 1 to 50 acres account for 46% of the total number of catchments, but their cumulative area equals only 3% of the total District area served by sewers. On the other hand, over 50% of the total District area served by sewers is accounted for by the 5 largest drainage catchments, which are only 5% of the total of 93 catchments. (Knapp-USGS)
W69-07486

HYDROGRAPHIC CONDITIONS OFF THE NORTHEAST COAST OF ICELAND IN RELATION TO METEOROLOGICAL FACTORS,
Marine Research Institute, Reykjavik (Iceland).
Unnsteinn Stefansson, and Gudmundur Gudmundsson.
Tellus, Vol 21, No 2, pp 245-258, 1969. 14 p, 5 fig, 3 tab, 11 ref.

Descriptors: *Hydrography, *Meteorological data, *Hydrologic properties, Mathematical models, Water circulation, Air temperature, Velocity, Statistical methods, Density, Summer, Winter, Gaging stations, Salinity, Numerical analysis, Pressure, Forecasting, Mapping.
Identifiers: Hydrographic conditions.

The relationship between oceanographical and meteorological parameters of the northeastern coast of Iceland was analyzed analytically and experimentally on the basis of a mathematical model and recorded data given in earlier publications. The study confirms the existence of a strong connection between the oceanographical conditions, air temperature, and N-S winds about 90 days prior to the observations. The study also shows that the air temperature is a more important factor than the winds and its effect on the influx of Atlantic water can be considered to be of indirect character. (Gabriel-USGS)
W69-07503

A NONLINEAR MODEL OF THE FLOW OF AN INHOMOGENEOUS FLUID AT THE EQUATOR (RUSSIAN),
Akademiya Nauk SSSR. Institut Okeanologii.
L. M. Krivelevich.
Transl in Vol 4, No 2, pp 188-198. Izv Akad Nauk, Atmos i Okeanicheskaya Fizeka, Vol 4, No 2, pp 105-110, Feb 1968. 6 p, 5 fig, 14 ref.

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Descriptors: *Mathematical models, *Mathematical studies, *Equations, *Flow characteristics, Velocity, Density, Water circulation, Thermocline, Water temperature, Water pressure, Diffusion, Momentum transfer.
Identifiers: Nonlinear flow model.

To explain the phenomenon of subsurface equatorial currents a nonlinear model of a current flow was postulated. This analytical model was based on a two-layer model developed by Felsenbaum and Shapiro (1966) and Charney (1960) and assuming the density of each layer to be a known constant value and the density of sea water to be an unknown parameter. By using an electronic computer it was demonstrated that the interaction of oceanic velocity and density fields produces results which agree with the flow patterns recorded at the equator of the oceans. (Gabriel-USGS)
W69-07529

2B. Precipitation

RAINFALL OVER GREAT BRITAIN AND NORTHERN IRELAND DURING 1968,
British Meteorological Office, London (England).
J. Grindley.
Water and Water Eng, Vol 73, No 878, pp 150-154, 161, Apr 1969. 6 p, 1 fig, 4 tab, 4 ref.

Descriptors: *Rainfall, *Meteorological data, *Climates, *Wet seasons, High water mark, Low water mark, Dry seasons, Storms, Precipitation (Atmospheric), Floods, Runoff, Temperature, Snowfall, Snowmelt, Anticyclones, Thunderstorms.
Identifiers: *Great Britain, *Northern Ireland.

Daily, monthly, and annual rainfalls over Great Britain and Northern Ireland were analyzed on the basis of precipitation data recorded at several gaging stations. The study shows that the total rainfall over England and Wales for 1968, although marginally smaller than that for 1967, was again substantially greater than average. The period 1965-68 has been the wettest period of 4 consecutive calendar years since 1927-1930. The year 1968 was dry in both Scotland and Northern Ireland although 1964 was considerably drier. (Gabriel-USGS)
W69-07362

DROUGHT IN AUSTRALIA: A PROBLEM OF PERCEPTION,
Flinders Univ., Bedford Park (Australia). Dept. of Geography.
For primary bibliographic entry see Field 02E.
W69-07371

HYDROLOGICAL FORECASTING IN THE USSR,
Hydrometeorological Service of the USSR (Moscow). Scientific Research Center.
V. V. Rakhmanov, and A. P. Shastin.
Nature and Resources, Vol 5, No 1, pp 9-13, Mar 1969. 5 p.

Descriptors: *Forecasting, *Streamflow forecasting, Flood forecasting, Synoptic analysis, Freezing, Rivers, Snowpacks, Infiltration, Runoff, Evaporation, Evapotranspiration.
Identifiers: USSR.

Hydrological forecasting agencies and techniques in the USSR are briefly reviewed. The most important research center was the Central Forecasting Institute, which in 1966 became the Hydrometeorological Research Center. The water balance method makes it possible to estimate river flow, water losses, and groundwater recharge. Snow sampling data are used in spring flood forecasting. Predictions of river ice formation and breakup are made by techniques of synoptic analysis. State institutes and university departments working in hydrology are listed and their work briefly described. Besides research, the Hydrometeorological Research Center furnishes forecasts, bulletins, warnings of dangerous hydrologic conditions, and notifies water users of particularly favorable conditions. The USSR hydrological network includes over 3000 stations. Annual aerial surveys are made of rivers, ice, and snow cover. (Knapp-USGS)
W69-07379

HYDROLOGIC AND CLIMATOLOGIC DATA, 1968, SALT LAKE COUNTY, UTAH,
Geological Survey, Salt Lake City, Utah.
A. G. Hely, R. W. Mower, and C. A. Horr.
Utah Basic-Data Release No 17, Open-file Rep, 1969. 70 p, 5 fig, 1 plate, 61 tab, 18 ref.

Descriptors: *Data collections, *Climatic data, *Hydrologic data, *Utah, Streamflow, Water quality, Water temperature, Water wells, Water levels, Precipitation (Atmospheric), Winds, Sediment discharge.
Identifiers: Salt Lake County (Utah).

Climatological groundwater and surface-water data for Salt Lake County, Utah, in 1968 are compiled. Tabulated data include precipitation, air temperature, evaporation, wind, well records, water levels, well discharges, water chemical analyses, stream water analyses, water temperatures, sediment discharges, and streamflow records. (Knapp-USGS)
W69-07407

METEOROLOGICAL AND HYDROLOGICAL DROUGHT IN RARITAN RIVER BASIN IN NEW JERSEY,
Rutgers - The State Univ., New Brunswick, N. J. Water Resources Research Inst.
Chin S. Liu, and W. B. Snow.
OWRR Project A-002-N.J. June 1969. 6 p.

Descriptors: *Droughts, Water balance, *Hydrologic data, Sequential generation, New Jersey, Meteorological data.
Identifiers: *Raritan River Basin, Hydrological data.

The 1961-66 drought in the Northern part of New Jersey was the most intense ever recorded in the region. The meteorological droughts, indicated by the Palmer Drought Index, and the corresponding hydrological droughts were investigated. The drought sequence is a time series characterized by a Markov chain process. Long sequences of generated drought data were utilized for evaluating the various drought distributions.
W69-07457

PHYSICAL STATE PROPERTIES OF PRECIPITATION,
Idaho Univ., Moscow. Dept. of Electrical Engineering.
G. A. McKean, and J. C. Read.
Research Technical Completion Report, March, 1969. 20 p, 4 tab, 5 fig, 9 ref. OWRR Project A-008-IDA.

Descriptors: *Precipitation, *Rain, *Snow, *Precipitation gages, Precipitation (Atmospheric), Rainfall (Impact), Rainfall distribution.

The object of this research was to study the properties of snow or rain in the falling state that would permit positive identification of the state of the precipitation. The ultimate application was to provide a record of when it was raining or snowing and to provide a means of relating the record to conventional recording precipitation gage records. Various properties of precipitation were evaluated both by literature search and by laboratory investigation. Properties investigated included conductivity, storage of static charge, impact momentum, acoustic energies, and both optical reflectivity and opacity. Optical reflectance proved to have the most promise and a scheme for making such a measurement was proposed. Subsequent to this a prototype device was developed.
W69-07458

SURFACE-RUNOFF MODEL DEVELOPE ANALYTICAL METHODS,
Tennessee Valley Authority, Knoxville.
For primary bibliographic entry see Field 02
W69-07464

RAINGAGE NETWORKS IN THE LARGE TIES,
American Society of Civil Engineers, Cam
Mass. Engineering Sciences Lab.
L. S. Tucker.
ASCE Urban Water Resources Res Progra
Mem No 9, Mar 17, 1969. 90 p, 24 fig,
USGS Contract No 14-08-0001-11257;
Contract No 14-01-0001-1585. Available
Clearinghouse as PB 184 704 at $3.00 in
copy and $0.65 in microfiche.

Descriptors: *Cities, *Rain gages, *Networ
strumentation, Rainfall-runoff relationships,
runoff, Storm drains, City planning, Utilities,
resources development.
Identifiers: Urban rain gage networks.

The extent of raingage networks in the 20
cities in the U. S. is described and the hist
available data is given. The number of raing
and around these cities varies from 1 to 16
cities of Boston, New York, Phoenix, Pitt
and San Francisco are served only by first
USWB recording raingage stations. Record
ingages in addition to the USWB statio
operated and maintained in and around 15
20 largest cities. These cities are Balt
Chicago, Cleveland, Dallas, Detroit, Housto
Angeles, Milwaukee, New Orleans, Philad
St. Louis, San Antonia, San Diego, Seattl
Washington, D. C. Information on the n
type, location, and history of the gages, and
form, use and availability of rainfall data fo
15 cities is presented. The metropolitan are
the largest network of recording raingages
Angeles where 162 raingages are operate
distance between most extreme raingages i
cess of 70 miles. Seattle has a unique meth
recording, reducing and processing rainfa
which was put in operation in early 1965. R
data are recorded on tapes, translated to co
cards and processed through a computer
minimum of manual data handling. Chicago
greatest amount of reduced historical data.
are 79 storms dating from 1932 to 1963 for
rainfall is reduced to 5-minute intervals for
work varying between 12 and 19 gages. A su
of the raingage network information for 15
20 largest cities is tabulated. (Knapp-USGS)
W69-07485

A TECHNIQUE TO INFER ATMOSPH WATER-VAPOR MIXING RATIO FROM SURED HORIZON RADIANCE PROFILES
National Aeronautics and Space Administ
Langley Station, Va. Langley Research Cent
For primary bibliographic entry see Field 07
W69-07491

HYDROGRAPHIC CONDITIONS OFF NORTHEAST COAST OF ICELAND IN TION TO METEOROLOGICAL FACTORS
Marine Research Institute, Reykjavik (Icelan
For primary bibliographic entry see Field 02
W69-07503

AUTOMATIC CALCULATION OF MONTHLY AND ANNUAL PRECIPITATI WHICH SOME MEASUREMENTS MISSING (FRENCH),
Office de la Recherche Scientifique et Tec
Outre-Mer, Paris (France). Dept. of Hydro
Research.
For primary bibliographic entry see Field 07
W69-07538

OPTIMIZATION TECHNIQUES IN WEA MODIFICATION,
Denver Research Inst., Colo.

Stinson.
c, Nat Symp Anal Water-Resource Syst, pp 79-
Denver, July 1968. 16 p, 8 fig, 11 ref.

criptors: *Weather modification, *Optimiza-
. *Systems analysis, *Clouds, Cloud seeding,
nputer programs, Simulation analysis, Mathe-
ical models, Precipitation (Atmospheric),
istical methods, Dynamic programming, Deci-
making.
tifiers: Precipitation management.

imum methods that can be used in the sequence
analyses and techniques called precipitation
agement or weather modification were
ussed. The weather modification system was
grammed and described, beginning with the
d system and cloud seeding technology, and
continuing with analytical techniques such as
istical tests and computer simulation. Several
ulation modeling approaches were outlined,
the use of dynamic programming for multistage
sion models for the total system was discussed.
as concluded that maximum effectiveness could
be achieved through the optimization of a
ience of the above processes and their interac-
s, using a scientific, interdisciplinary approach
ch included systems engineering, systems analy-
and other operations research techniques. For
n entry see W69-07562. (Gysi-Cornell)
9-07566

. Snow, Ice, and Frost

**DROLOGICAL FORECASTING IN THE
R,**
rometeorological Service of the USSR
scow). Scientific Research Center.
primary bibliographic entry see Field 02B.
9-07379

**SULTS OF THEORETICAL AND EXPERI-
NTAL STUDIES OF FRAZIL ICE TRANS-
RT BY SUSPENSION IN A STREAM (RUS-
N),**
Union Scientific Research Inst. of
rotechnics and Reclamation (USSR).
. Zagirov.
l Akad Nauk Tadzh SSR, Vol 11, No 7, pp 16-
1968. 5 p, 2 fig, 7 ref.

criptors: *Frazil ice, *Transportation,
spended load, *Streamflow, *Mathematical
ies, Winter, Velocity, Hydrologic data, Tem-
ture, Critical flow, Freezing, Roughness coeffi-
t, Hydraulic properties.
tifiers: Frazil ice stream transport.

zil ice transport by streams was investigated
ytically and experimentally. The analytical
ysis was made on the basis of the theory of
gy transport developed by G. T. Dmitriyev
52) and experimental formulas on the weight of
il ice in a stream current developed by V. M.
apov (1955), professor A. S. Obrazovskiy
52), and the author (1968). The experimental
ies show that the stream velocities which
rantee a complete distribution of frazil ice in a
am current are correctly given by using the
ior's formula. (Gabriel-USGS)
9-07416

**GANIC MATTER IN THE GLACIOMARINE
IMENTS OF THE EASTERN ANTARCTIC,**
demiya Nauk SSSR. Institut Geologii i
rabotki Goryuchikh Iskopaemykh.
primary bibliographic entry see Field 02J.
9-07528

. Evaporation and Transpiration

**L MOISTURE DEPLETION AND ESTI-
TED EVAPOTRANSPIRATION ON UTAH
TERSHEDS,**
rmountain Forest and Range Experiment Sta-
, Ogden, Utah.
Norbert V. DeByle, Robert S. Johnston, Ronald K. Tew, and Robert D. Doty.
International Conference on Arid Lands in a Changing World, Arizona University, Tucson, June 3-13, 1969. 14 p, 3 fig, 3 tab.

Descriptors: *Watershed management, *Evapotranspiration, *Soil-water-plant relationships, *Vegetation effects, Watersheds (Basins), Arid lands, Water yield improvement, Hydrologic cycle, Soil moisture, Water balance, Habitat improvement, Ground cover effects, Utah.

Evapotranspiration is the principle component of the hydrologic cycle that can be modified by watershed managers. In the western U.S. measured soil moisture depletion plus summer precipitation gives a good estimate of actual evapotranspiration. 14 sites representing 10 vegetative types typical of Utah's water yielding lands were studied. Soil moisture depletion during the growing season, measured with the neutron scatter technique, varied from 0.88 in. under a young stand of aspen sprouts to 20.38 in. under a mature aspen stand. Losses from grass, Gamble oak, sagebrush, snow berry, Douglas fir and bare soil were intermediate. The resulting inventory of water use by native plant communities, elevation 6,100 ft. to 9,200 ft., provides a basis for further water yield improvement research, especially for measuring effects of converting or modifying vegetation on watersheds in arid regions. (Sherbrooke-Ariz)
W69-07347

THE INFLUENCE OF EVAPORATION ON THE QUALITY OF WATER STORED IN SAND,
National Inst. for Water Research, Windhoek (South Africa).
D. H. R. Hellwig.
International Conference on Arid Lands in a Changing World, Arizona University, Tucson, June 3-13, 1969. 30 p, 8 tab, 7 fig, 6 ref.

Descriptors: *Evaporation, *Underground storage, *Arid lands, Soil water movement, Water loss, Natural recharge, Subsurface waters, Aeolian soils, Water table, Hydrologic properties, Leaching, Salt balance, Soil water, Dissolved solids.
Identifiers: South West Africa.

A determination was made of the effect of evaporation on the salt concentration of water at various depths, when stored in sand. Three different sand mixtures in 10 evaporation tanks with three different water tables were used. Rate of evaporation and loss of salts from solution increased with firmness of sand and decreasing depths of water table from the surface. Salt loss from solution (%) increased with evaporation according to a hyperbolic relationship; salt accumulated at or above the water table. Water quality near the bottom was unchanged by high evaporation. Heavy rain washed salts from sand above the water table downward, increasing the T.D.S. concentration. This effect increased with coarseness of sand and depth of water table. These results assist in a better understanding of the influence of evaporation on the salt concentration of water stored in sand beds of rivers in arid regions. (Sherbrooke-Ariz)
W69-07349

THE EFFECT OF INORGANIC SEDIMENT ON STREAM BIOTA,
DePauw Univ., Greencastle, Ind.
For primary bibliographic entry see Field 05C.
W69-07455

HEAT FLUX AND TEMPERATURE VARIATION AT A WAVY WATER-AIR INTERFACE,
State Univ. of New York, Stony Brook. Coll. of Engineering.
Edward E. O'Brien, and Thore Omholt.
J Geophys Res, Vol 74, No 13, pp 3384-3385, June 20, 1969. 2 p, 6 ref. NSF Grant No GK1715.

Descriptors: *Air-water interfaces, *Waves (Water), *Heat flow, *Heat transfer, Convection, Conduction, Evaporation, Boundary processes, Heat balance, Temperature, Thermal stratification, Solar radiation.
Identifiers: Heat flux.

Surface temperature and heat flux variations induced by a progressive wave on a thin layer of water across which steep thermal gradients exist may be predicted. It is shown that molecular conduction and convection due to the wave alone, excluding any buoyancy induced convection, do not account for the behavior of the surface temperature that has been observed in a wave tank. (Knapp-USGS)
W69-07487

EVAPORATION FROM AN EXTREMELY NARROW WET STRIP AT GROUND LEVEL,
Cornell Univ., Ithaca, N. Y.
Wilfried Brutsaert, and Gour-Tsyh Yeh.
J Geophys Res, Vol 74, No 13, pp 3431-3433, June 20, 1969. 3 p, 1 fig, 4 ref. NSF Grant No GK-312.

Descriptors: *Evaporation, *Air-earth interfaces, *Soil water, Boundary processes, Mathematical models, Water loss, Heat budget, Mass transfer, Solar radiation, Microenvironment, Soil water movement, Winds, Convection, Turbulence, Diffusion, Dispersion.
Identifiers: Wet ground evaporation.

A solution is obtained for the turbulent diffusion equation, considering only the upward and forward diffusion but neglecting the lateral diffusion and the forward convection by the mean wind. With the proper boundary conditions this equation describes evaporation from an extremely narrow wet surface at ground level, which extends laterally to infinity. Comparison of this solution with an earlier solution for evaporation from an extremely small circular surface shows that the effect of lateral diffusion on the evaporation from such a surface increases with increasing stability of the atmosphere. This effect is under neutral conditions probably of the order of 13%. (Knapp-USGS)
W69-07488

STUDY OF ENERGY BALANCE AT BRAZZAVILLE (FRENCH),
Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France). Dept. of Hydrological Research.
Ch. Riou, and R. Chartier.
Cah ORSTOM, Ser Hydrol, Vol 5, No 4, pp 25-42, 1968. 18 p, 4 fig, 4 photo, 1 tab, 3 ref.

Descriptors: *Energy budget, *Energy equation, *Evapotranspiration, Lysimeters, Temperature, Latent heat, Sun, Radiation, Albedo, Air circulation, Heat balance, Atmospheric physics, Humidity, Soil temperature, Seasonal, Heat flow, Vegetation, Forests, Vapor pressure, Tension, Turbulence.
Identifiers: Brazzaville energy-balance study.

This investigation was the study of the application of the energy-balance method to the data given by Bowan in his report on a turbulent flow observed at Brazzaville and R. Charteer's albedo measurements conducted in the Brazzavile area. The computed parameters of the energy balance method were the total radiation, reflected radiation, temperature and humidity gradients above the ground, temperature gradient of the ground, evapotranspiration, and other pertinent coefficients. The study shows that it is perhaps premature to draw some definite conclusions from the results of this study, although the goal of this study was the presentation of a technique suitable for a humid climate. However, it is strongly believed that an improved energy-balance method offers the best possibility for the determination of the reaction of vegetable cover to the solar energy radiation. (Gabriel-USGS)
W69-07537

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2E. Streamflow and Runoff

STREAM BOUNDARIES OF SUBCRITICAL FLOW IN A TRAPEZOIDAL CHANNEL EXPANSION,
London Univ. (England); and West Ham College of Tech., London (England).
S. K. A. Naib.
Water and Water Eng, Vol 73, No 878, pp 155-158, Apr 1969. 4 p, 8 fig, 11 ref.

Descriptors: *Subcritical flow, *Streamflow, *Streamflow forecasting, *Model studies, Mathematical studies, Flow measurement, Jets, Velocity, River beds, Slopes, Energy dissipation, Pressure, Water Circulation.
Identifiers: Critical flow model study.

Stream boundaries of subcritical flows were investigated by both analytically and experimentally by using rectangular and trapezoidal channel models and a theoretical solution for the flow behind a two-dimensional bluff body developed by G. K. Abramovich. Measurements of the velocity profiles and flow boundaries in the mixing region of a rectangular stream expanding abruptly into a trapezoidal channel with side slopes of 1 vertical to 2 horizontal were made and presented here as the generalized curves of velocity profiles, spreading of stream boundaries, variation of left and drag coefficients, and other parameters. A rational method for designing the protection downstream of sudden transitions is suggested. (Gabriel-USGS)
W69-07366

METEOROLOGICAL CAUSES FOR THE AUGUST FLOODS BETWEEN 1950 AND 1960 (FRENCH),
Rene Viala.
Rev Geogr Des Pyrenees Et Sud-Ouest, Vol 40, No 2, pp 171-178, Apr 1969. 8 p, 5 fig, 3 tab.

Descriptors: *Floods, *Meteorological data, Water balance, Rain, Precipitation (Atmospheric), Climates, Discharge (Water), Gaging stations, High water mark, Low water mark, Winter, Summer, Spring, Storm runoff, River basins, Winds.
Identifiers: Meteorological causes of floods.

Meteorological effects on August floods were investigated on the basis of hydrological and meteorological data recorded in France during the 1950-1960 period. The study shows that the topography of a region, the line separating the Atlantic waters from those of the Mediterranean Sea, and rain intensity play a significant role in developing floods in France. (Gabriel-USGS)
W69-07367

TIDAL WAVE CALCULATIONS FOR VARIOUS RIVER REGULATION STAGES DEMONSTRATED BY EXAMPLE OF THE LOWER WESER AND THE LOWER HUNTE RIVERS (German),
For primary bibliographic entry see Field 02L.
W69-07368

FLOOD PLAIN INFORMATION OF SOUTH FORK PALOUSE RIVER AND MISSOURI FLAT CREEK, PULLMAN, WASHINGTON.
Corps of Engineers, Walla Walla, Wash.
For primary bibliographic entry see Field 04A.
W69-07370

DROUGHT IN AUSTRALIA: A PROBLEM OF PERCEPTION,
Flinders Univ., Bedford Park (Australia). Dept. of Geography.
R. L. Heathcote.
Geogr Rev, Vol 59, No 2, pp 175-194, Apr 1969. 20 p, 4 fig, 60 ref.

Descriptors: *Droughts, *Rainfall, *Climates, *Meteorological data, Water uses, Plants, Animal populations, Plant growth, Moisture availability, Water shortage, Economics, Water costs, Water resources development, Soils, Ecology, Arid lands, Water policy.
Identifiers: *Australia, South Australian drought.

This article defines the drought phenomenon in general and investigates its occurrence in Australia in the periods 1888-1900 and 1958-1965. The investigation contains the following chapters: (1) the identification of drought (definition, measurement, registration); (2) the recognition of drought effects (negative effects, positive effects); (3) the appraisal of drought (attitudes and reactions); and (4) planning for the future. (Gabriel-USGS)
W69-07371

A SEMIAUTOMATIC METHOD FOR REDUCING STREAMFLOW RECORDS,
Utah State Univ., Logan. Dept. of Forest Science.
For primary bibliographic entry see Field 07C.
W69-07376

FLOOD PLAIN INFORMATION, CEDAR RIVER, RENTON, WASHINGTON.
Corps of Engineers, Seattle, Wash.
For primary bibliographic entry see Field 04A.
W69-07384

SPATIAL ORDER IN FLUVIAL SYSTEMS: HORTON'S LAWS DERIVED FROM MIXED HEXAGONAL HIERARCHIES OF DRAINAGE BASIN AREAS,
Harvard Univ., Cambridge, Mass. Computer Graphics and Spatial Analysis Lab.
For primary bibliographic entry see Field 04A.
W69-07394

THE WILLAMETTE RIVER, FLOOD CONTROL OR FLOOD MANAGEMENT,
Oregon State Univ., Corvallis. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 04A.
W69-07395

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS, IN NEBRASKA.
Corps of Engineers, Omaha, Nebr. Missouri River Div.
For primary bibliographic entry see Field 04A.
W69-07397

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN NORTH DAKOTA.
Corps of Engineers, Omaha, Nebr. Missouri River Div.
For primary bibliographic entry see Field 04A.
W69-07398

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN OHIO.
Corps of Engineers, Huntington, W. Va. Ohio River Div.
For primary bibliographic entry see Field 04A.
W69-07399

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN OKLAHOMA.
Corps of Engineers, Dallas, Tex. Southwestern Div.
For primary bibliographic entry see Field 04A.
W69-07400

WATER RESOURCES DEVELOPMENT THE U.S. ARMY CORPS OF ENGINEER OREGON.
Corps of Engineers, Portland, Oreg. North P Div.
For primary bibliographic entry see Field 04A
W69-07401

WATER RESOURCES DEVELOPMENT THE U.S. ARMY CORPS OF ENGINEER PUERTO RICO AND THE VIRGIN ISLAND
Corps of Engineers, Atlanta, Ga. South At Div.
For primary bibliographic entry see Field 04A
W69-07402

THE EFFECT OF THE BEGINNING O HYDROLOGICAL YEAR ON THE STAT CAL PARAMETERS OF STREAMFLOW REQUIRED RESERVOIR CAPACITY (SIAN),
Nauchno-Issledovatelskii Gidroenergeticheskstitut, Tiflis (USSR).
G. G. Svanidze, and A. N. Kilasoniya.
Meteorol Gidrol, No 1, pp 66-73, 1969. 8 p, 4 tab, 9 ref.

Descriptors: *Parametric hydrology, *Stream *Streamflow forecasting, *Statistical met *Mathematical studies, Runoff, Disc (Water), Hydrograph analysis, Reservoir sto Seasonal, River basins, Low water mark, Co tion analysis.
Identifiers: *USSR, Reservoir capacity, Stati parameters.

The effects of the beginning of a hydrological were investigated analytically and experime using statistical methods and hydrograph recorded at the hydrological stations along th gara, Neva, Volga, and other rivers of the U The study shows that the mean annual discharge can be considered as practically stat ry and can be considered as being of a cor value for different hydrograph divisions. The shows that though the annual runoff value basically constant the transfer of single month noffs from one group to another introduces siderable changes in the maximum values of a runoff. (Gabriel-USGS)
W69-07403

FLOODS IN RICHMOND QUADRAN NORTHEASTERN ILLINOIS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 04A.
W69-07405

WATER RESOURCES OF THE MILL RIVER BASIN, NORTH-CENTRAL SACHUSETTS AND SOUTHWESTERN HAMPSHIRE,
Geological Survey, Washington, D. C.
M. R. Collings, D. R. Wiesnet, and W. B. Fleck
Geol Surv Hydrol Invest Atlas HA-293, 4 s 1969. 44 fig, 2 map, 9 tab, 37 ref.

Descriptors: *Water resources, *Surface wa *Groundwater, *Massachusetts, *New Hamps Water wells, Water quality, Streamflow, Ru Aquifers, Reservoirs, Stream gages, Hydro budget.
Identifiers: Millers River (Mass-N. H.).

The water resources of the Millers River B Massachusetts and New Hampshire are marized in a 4 sheet hydrologic atlas consisti maps, graphs, charts, and text. Streamflow, fl precipitation, reservoir storage, divers aquifers, pumpage, well yields, transmissiv water quality, water utilization, and pollutio discussed and data are presented graphically napp-USGS)
W69-07406

AILABILITY OF RAINFALL-RUNOFF DATA
R SEWERED DRAINAGE CATCHMENTS,
erican Society of Civil Engineers, Cambridge,
s.
primary bibliographic entry see Field 02A.
9-07484

EW METHOD OF INVESTIGATING RIVER
ESSION CURVES,
River Authority, Newport (England).
primary bibliographic entry see Field 07B.
9-07493

CONNAISSANCE OF THE RED LAKE
ER, MINNESOTA,
logical Survey, Washington, D. C.
primary bibliographic entry see Field 04A.
9-07505

TER RESOURCES OF THE BIG OTTER
EEK DRAINAGE BASIN,
er Resources Commission (Ontario).
primary bibliographic entry see Field 03B.
9-07508

OD PLAIN INFORMATION OF GRAND
ER, INGHAM COUNTY AND EATON
UNTY, MICHIGAN.
ps of Engineers, Detroit, Mich.
primary bibliographic entry see Field 04A.
9-07509

OD PLAIN INFORMATION OF BLACK
ER, SPRINGIELD, VERMONT.
ps of Engineers, Waltham, Mass. New England

primary bibliographic entry see Field 04A.
9-07510

TER RESOURCES OF WINDWARD OAHU,
WAII,
logical Survey, Washington, D. C.
Takasaki, G. T. Hirashima, and E. R. Lubke.
l Surv Water-Supply Pap 1894, 1969. 119 p, 56
3 plate, 22 tab, 37 ref.

criptors: *Water resources, *Groundwater,
waii, Aquifers, Permeability, Streamflow,
er storage, Discharge (Water), Water wells,
er quality, Data collections, Hydrologic data,
er-level fluctuations, Water levels.
tifiers: Oahu (Hawaii).

es, mostly vertical and parallel or subparallel to
fissure zone, control movement and discharge
roundwater because they are less permeable
the rocks they intrude. Dikes impound or
ly impound ground water by preventing or re-
ing its movement toward discharge points.
neability is high in less weathered mountain
s and is highest farthest away from the dike
plex. Ground-water storage fluctuates to some
ee owing to limited changes in the level of the
nwater reservoir-maximum storage is about
00 million gallons. Perennial streams intersect
-level water and collectively form its principal
harge. The larger streams are those that cut
est into high-level reservoirs. Except near the
t in the northern end of the area, where dikes
absent, total base flow of streams equals total
ndwater discharge. The dependable flow of
r is estimated at 118 mgd, of which 84 mgd is
harged by streams, tunnels, springs, and wells.
remaining 34 mgd is underflow, most of it
harging into the sea near the northern end of
rea. Average flow is estimated at 220 mgd, of
h 150 mgd is inventoried flow and 61 mgd is
nated underflow. Specific capacity of wells
ing lava flows of the Koolau Volcanic Series
es from less than 1 to 11 gpd/ft of drawdown in
dike-complex zone and from 2 to 100 in the
ginal dike zone. A transmissivity of 4,000,000
ft was determined for the basal aquifer. The
nical quality of water in wells and tunnels tapping rocks of the Koolau and Honolulu Volcanic Series is excellent. (Knapp-USGS)
W69-07516

BIBLIOGRAPHY OF HYDROLOGY OF THE UNITED STATES AND CANADA,
Geological Survey, Washington, D. C.
J. R. Randolph, N. M. Baker, and R. G. Deike.
Geol Surv Water-Supply Pap 1864, 1969. 323 p, 310 ref.

Descriptors: *Bibliographies, *Hydrology, *United States, Hydrologic data, Publications, Water resources, Groundwater, Surface waters, Hydraulics.
Identifiers: *Canada.

References to books, journal articles, and other publications in hydrology published in the U.S. in 1964 are listed. Some references are taken from international journals. Previous bibliographies prepared by various organizations are listed. Citations are listed alphabetically by author, with full title and publication data. The index combines subject and geographic headings. (Knapp-USGS)
W69-07517

DIGITAL SIMULATION OF CHANNEL NETWORKS,
IBM Watson Research Center, Yorktown Heights, N. Y.
J. S. Smart, A. J. Surkan, and J. P. Considine.
Comm of Surface Waters, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 75, pp 87-98, 1967. 12 p, 3 fig, 4 tab, 13 ref.

Descriptors: *Synthetic hydrology, *Stochastic processes, *River systems, *River basins, *Computer programs, Computer models, Digital computers, Statistical methods, Monte Carlo method, Probability.
Identifiers: Random walk method.

The random-walk method proposed by Leopold and Langbein for simulating channel networks has been programmed for a digital computer. Rules for generating the patterns are described in detail and a flow chart of the program is given. Analysis of about 600 networks produced by the program shows that the means and ranges of dimensionless geomorphological parameters are very similar to those observed in real stream systems. The stream number distributions for the simulated networks are in fair agreement with Shreve's theory but there are systematic deviations. Analysis of length distribution data suggests that first order streams in actual networks have an exponential length distribution. (Knapp-USGS)
W69-07542

DISCHARGE AS RELATED TO STREAM SYSTEM MORPHOLOGY,
Illinois State Water Survey, Urbana.
John B. Stall, and Yu-Si Fok.
Comm of Surface Waters, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 75, pp 224-235, 1967. 12 p, 7 fig, 1 tab, 11 ref.

Descriptors: *Channel morphology, *Discharge (Water), *Illinois, Meanders, Geomorphology, Slopes, Alluvial channels, Banks, Beds, Depth, Shape, Slopes, Width, Channel erosion, Channel flow, Hydraulics, Regimes, Streamflow.
Identifiers: *Drainage basin morphology, Hortons law, Stream orders, Embarras River (Ill).

The basin of the Embarras River in Illinois is 2,400 sq mi in size and about 90% of the land is cultivated. The streams have relatively shallow gradients and the basin is typical of much of the mid-western USA. The Embarras has a drop of 317 ft throughout its course of 202 mi, for an average slope of 1.6 ft per mi. The morphological structure of the stream system has been analyzed using the Horton-Strahler stream ordering system. The stream network conforms to an excellent degree to the following laws of Horton: the law of stream numbers, the law of stream lengths, and the law of stream slopes. The sinuosity of streams in the basin is shown to increase geometrically with the stream order. Discharges at 8 stream gaging stations within the basin are shown to be related to stream order and to the frequency of occurrence of the discharge. Discharge measurements of the 8 stream gaging stations provide rating curves through which other hydraulic factors of the stream can be related to stream order. (Knapp-USGS)
W69-07547

THE INFLUENCE OF VEGETATION ON CHANNEL FORM OF SMALL STREAMS,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.; and Johns Hopkins Univ., Baltimore, Md. Dept. of Geography.
R. C. Zimmerman, J. C. Goodlett, and G. H. Comer.
Comm of Surface Waters, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 75, pp 255-275, 1967. 21 p, 8 fig, 3 tab, 9 ref.

Descriptors: *Channel morphology, *Vegetation effects, Streamflow, Stage-discharge relations, Roughness (Hydraulic), Retardance, Slopes, Width, Depth, Channel flow, Bank erosion, Erosion, Sediment yield.
Identifiers: Channel forms, Bank shear strength.

Data on channel width of several small streams in the Sleepers River basin of northern Vermont show the influence of vegetation on channel form. Channel width in small streams is clearly related to type of vegetation, as channels are alternately wide under forest and narrow in sod. Along one stream, width increases in response to increases in discharge where the drainage area exceeds 0.3 sq mi, but the variability in width also increases, reaching a maximum where the drainage area is about 2 sq mi. Relatively uniform channel widths occur where the drainage area is about 6 sq mi. Similar relationships were found in other streams sampled. In the Sleepers River basin there are apparently 2 thresholds along streams. In a downstream direction, the first threshold occurs where drainage areas are 0.2 to 0.8 sq mi. Upstream from the threshold width does not increase with discharge, living tree roots cross the channel, and dams of organic debris are common. The flow is commonly underground. Where drainage areas are 0.2-0.8 sq mi, annual high flows are 10 to 20 cfs. With drainage areas exceeding 0.2-0.8 sq mi, widths increase, but channel form is highly variable, and mean channel widths may vary by as much as 5 feet depending upon the type of vegetation. Relatively uniform channel widths occur, regardless of vegetation, where the drainage areas exceed 4 to 6 sq mi. Drainage areas about 5 square miles are apparently the second threshold. These have annual high flows in the range of 100 to 150 cfs. With higher discharge, the influence of vegetation on channel form is marginal compared with that of geologic differences and the sinuousity of the flow itself. Vegetation influences channel form by varying the roughness and shear strength of bed and banks. (Knapp-USGS)
W69-07550

OBSERVATIONS ON UNMEASURED RIVERS,
Geological Survey, Washington, D. C.
Luna B. Leopold, and Herbert E. Skibitzke.
Geogr Ann, Vol 49, Ser A, No 2-4, pp 247-255, 1967. 9 p, 9 fig, 2 tab, 2 ref.

Descriptors: *Water measurement, *Surveys, *Hydrologic data, Streamflow, Stream gages, Current meters, Depth, Hydrographs, Discharge measurment, Estimating, Stage-discharge relations, Rivers, Water levels, Hydraulics, Discharge (Water).
Identifiers: Ungaged rivers, Streamflow estimation.

An analysis of data on hydraulic parameters collected during single boat trips down river systems is

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presented, plotted in form of the hydraulic geometry. The data were taken on 2 separate boat trips down rivers. In one, no previous measurements were available but there is 1 gaging station downstream; the river studied is the John River, Alaska. The other river is the Middle Fork of the Salmon River, Idaho, Snake River system, from Dagger falls to the Salmon River, assistance of about 100 mi. In this basin there are several gaging stations, but the records from these were studied only after the field expedition was over. A dimensionless rating curve is used to estimate bankfull and average discharge for basins of various sizes. When compared with gaging station data, estimates of bankfull discharge are as consistent and possibly are equal in accuracy to estimates made from gaging station data. Estimates of average discharge are less consistent; within the range of drainage areas represented by the gaging stations, errors of estimate vary from 0 to 58%. Local variations of bed material size along the river are compensated mostly by changes in local channel slope and roughness and do not much affect the progressive downstream changes in width, depth, or velocity. (Knapp-USGS)
W69-07551

2F. Groundwater

THEORETICAL ANALYSIS OF REGIONAL GROUNDWATER FLOW, 3. QUANTITATIVE INTERPRETATIONS,
R. Allan Freeze, and P. A. Witherspoon.
Water Resources Research, V 4, No 3, pp 581-590, June, 1968. 10 p, 3 fig, 13 ref.

Descriptors: *Mathematical models, *Basins, *Groundwater movement, Arid lands, Subsurface drainage, Water balance, Watersheds (Basins), Darcy's law, Flow nets, Safe yield, Groundwater recharge, Discharge (Water), Digital computers, Water resources development.

The natural basin ground water yield can be calculated from a quantitative analysis of the flow net obtained from a digital computer solution to a numerical mathematical model of the basin. The natural basin yield can be considered as a measure of the groundwater recharge to the basin and a conservative estimate of the safe yield. Rates of groundwater recharge and discharge vary geographically within a basin; positions of concentration can be determined by quantitative analysis. Quantitative interpretation of groundwater flow nets can play an important role in the calculation of basin-wide water balances. These methods can be useful in planning the development of many arid or semi-arid near-virgin basins in the American west and the Canadian prairies. (Sherbrooke-Ariz)
W69-07339

GRAVIMETRIC ESTIMATION OF DEPTH TO AQUIFERS IN THE HAZEVA AREA, ARAVA VALLEY, ISRAEL,
P. R. May.
Israel Journal of Earth-Sciences, v 17, no 1, pp 30-43, 1968. 14 p, 7 fig, 5 ref.

Descriptors: *Hydrologic aspects, *Gravity studies, Aquifer characteristics, Arid lands, Limestones, Geologic formations, Groundwater basins, Depth.
Identifiers: Arava Valley, Israel.

Aquifers in the Judea limestone extend from outcrops on the Negev uplands to the arid Hazeva area in the Arava Valley and eastward to the western border fault of the Dead Sea graben. A gravity survey shows the Hazeva area to be part of a shallow intermontane basin in which the Judea limestone lies at depths of 100 m. in the S.W. to 450 m. on the east. Depth estimations are made at six localities along the bounding faults by direct computation of the total anomaly caused and the maximum residual gradient. The principle density interface in the geologic column occurs at the top of the Judea limestone. The area east of the Sedom-Elat highway, but west of the badlands of Nahal Idan, is topographically the best suited to settlement and agriculture. A groundwater exploration drilling program should include penetration of the Cenomanian position, with wells drilled to at least 200 m. below the top of the limestone. (Sherbrooke-Ariz)
W69-07341

COMPOSITIONAL SIMILARITIES BETWEEN HOT MINERAL SPRINGS IN THE JORDAN AND SUEZ RIFT VALLEYS,
Israel Atomic Energy Commission, Rehovoth; and Weizmann Inst. of Science, Rehovoth (Israel).
Emanuel Mazor.
Nature, v 219, August 3, pp 477-478, 1968. 2 p, 2 fig, 7 ref.

Descriptors: *Hot springs, *Mineral water, *Aquifer characteristics, Water chemistry, Geologic control, Water temperature, Encroachment, Mixing, Saline water intrusion.
Identifiers: Jordan Rift Valley, Suez Rift Valleys.

The chemical composition of the Hammam Farun hot spring (72 deg C) in the Suez Rift Valley is found to be almost identical to that of the Tiberias Hot Springs (60 deg C) in the Jordan Rift Valley. The chemical nature of the Tiberias Hot Springs is hypothesized to result from a past oceanic invasion of the valley, whose waters reacted with the host rocks. The composition of Hammam Farun spring, 30 m. from the sea, is attributed to deep seawater mixing with local groundwater, having reacted with the host rock. Expected ionic changes are verified. Springs of the arid Jordan Rift Valley are thought to result from the continuous tectonic activity of the area forcing deep hot mineral waters to the surface. (Sherbrooke-Ariz)
W69-07342

OUTLINES OF GROUNDWATER RESOURCES OF SAUDI ARABIA,
Ministry of Agriculture and Water, Riyadh (Saudi Arabia).
Galip Otkun.
International Conference on Arid Lands in a Changing World, Arizona University, Tucson, June 3-13, 1969. 16 p, 2 fig, 1 tab, 14 ref.

Descriptors: *Aquifer characteristics, Aquifers, Artesian wells, Deep wells, Depth, Discharge coefficient, Geologic formations, Groundwater recharge, Groundwater, Subsurface water, Karst, Hydrogeology, Natural recharge, Specific yield, Arid lands, Deserts.
Identifiers: Saudi Arabia.

A report on the characteristics and development of the groundwater resources of the desert Kingdom of Saudi Arabia, which lacks perennial rivers and has only scarce sporadic showers. In recent years hydrogeological investigations and drilling of more than a thousand production and exploratory wells revealed the existence of 16 aquifers, at least 10 of which are reliable and prolific. Nine of these are treated in detail, including information on geology, depth, transmissibility, number of wells, total dissolved solids, age, recharge, infiltration rate, geographic extent, and importance to the economy. Saudi Arabia which is very poor in surface water possesses rich groundwater resources. Included are a block diagram of geologic structures, a geologic map, and a table of aquifer characteristics. (Sherbrooke-Ariz)
W69-07354

HYDROGEOLOGICAL APPRECIATIONS OF THE PROVINCE OF LA RIOJA,
Mario V. J. Sosic.
International Conference on Water for Peace, Washington, D. C., 1967, Water for Peace, v 4 (Basic Data for Water Programs), p. 928-932, 1968. 4 p. For 8 volume proceedings see vol 2 no 9, field 06B, W69-03305.

Descriptors: *Hydrological aspects, *Arid la
Streamflow, Aquifer characteristics, De
Groundwater basins, Hydrogeology, Hydrol
properties, Saline soils.
Identifiers: La Rioja Prov. (Argentina).

Situated in the arid Argentine Northwest, La F
Province possesses a considerable reserve of
derground water, which is hardly exploited and
completely investigated. Economic progress
requires the rational use of surface waters. The
lowing hydrogeologic zones are discussed: (1)
La Rioja Plains, (2) southern areas of Sala
Pipanaco, (3) the valley of river San Blas de
Sauces, (4) the alluvial cones of the rivers S
Cruz, Campanas, Pituil, (5) Valley of
Colorados Antinanco, (6) Valley of River Bern
(7) the Pocket of Jague, and (8) Valley of G
dacol. Topics considered include quality of w
depth of water, demand for water, river syst
well yields, soil salinity, and regional economy.
4 most propitious areas for rational undergro
water exploitation are indicated. (Sherbro
Ariz)
W69-07358

**A GEOMETRIC METHOD TO SUBDIVIDE T
PATAPSCO FORMATION OF SOUTH
MARYLAND INTO INFORMAL MAPP
UNITS FOR HYDROGEOLOGIC USE,**
Maryland Geological Survey, Baltimore.
For primary bibliographic entry see Field 07B.
W69-07387

**AN ESSENTIAL FACTOR IN THE NATU
WATER CYCLE: THE RATE OF CIRCU
TION IN PERMEABLE GROUNDS (FRENCH**
Strasbourg Univ. (France). Lab. of H
Mechanics.
L. Zilliox, A. Amirsadri, and C. Kopp.
Terres and Eaux, Rev Int de L'Hydraul, Vol 22
58, pp 29-34, Jan-Mar 1969. 6 p, 5 fig, 1 tab, 6

Descriptors: *Water circulation, *Velo
*Groundwater, *Permeability, Model stu
Porous media, Tracers, Piezometers, Mathema
studies, Darcy's law, Filtration, Saturated flow
noff, Discharge (Water).
Identifiers: Underground water circula
Permeability effect on water circulation.

This article describes the development and use
laboratory model of special techniques of meas
ment of the rate of circulation of groundwate
bles. More specifically, the purpose of the s
was to determine, with satisfactory limits of pr
bility, the time taken by a tracer to travel
porous media from a point of emission t
reference point at a distance L. In carrying out
model studies, an injection shaft with a perfor
piston allowing the instantaneous and limited in
tion of a chemical electrolyte tracer and a piezo
ter were used. The piezometer located downstr
in the same line of flow served for the electrica
tection of the tracer. The study shows that the c
bination of experimental model study with the
of hydraulic and optical met hods serves for a n
precise evaluation of groundwater veloci
(Gabriel-USGS)
W69-07391

**WATER RESOURCES OF THE MILL
RIVER BASIN, NORTH-CENTRAL M
SACHUSETTS AND SOUTHWESTERN N
HAMPSHIRE,**
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
W69-07406

**GEOPHYSICAL AND GEOLOGICAL STUD
OF THE RELATIONSHIPS BETWEEN T
DENVER EARTHQUAKES AND THE ROC
MOUNTAIN ARSENAL WELL, PART A,**
Colorado School of Mines, Golden. Dept
Geophysics; and Colorado School of Mines,
den. Dept. of Geology.

hn C. Hollister, and Robert J. Weimer.
olo School Mines Quart, Vol 63, No 1, Jan 1968.
1 p, 9 pap.

escriptors: *Earthquakes, *Injection wells, Vaste disposal, *Colorado, Hydrostatic pressure, actures (Geology), Faults (Geology), Ground-ter basins, Aquifers, Structural geology, Pore essure.
entifiers: Denver (Colo), Rocky Mountain Ar-nal.

rthquakes at Denver, Colorado cause public ncern because they are apparently related to the eration of a deep waste-disposal well at the cky Mountain Arsenal. Seismograph studies, ological investigations, and study of deep-well cords were financed and made to determine the igin and mechanisms of the earthquakes. It is the lief of the majority of the investigators that injec-n of liquid wastes contributes to earthquake ac-ity. The effect of injection on earthquakes could t have been predicted when the well was drilled 1961. The reservoir should be allowed to come equilibrium without further injection or thdrawal of fluids. (Knapp-USGS)
69-07410

ROPERTIES OF THE ROCKY MOUNTAIN RSENAL DISPOSAL RESERVOIR AND THEIR ELATION TO DERBY EARTHQUAKES,
olorado School of Mines, Golden. Dept. of ophysics.
R. Pickett.
olo School Mines Quart, Vol 63, No 1, pp 73-100, n 1968. 28 p, 12 fig, 6 tab, 10 ref, 1 append.

escriptors: *Earthquakes, *Injection wells, Vaste disposal, *Colorado, Hydrostatic pressure, actures (Geology), Faults (Geology), Ground-ter basins, Aquifers, Porosity, Permeability, ructural geology, Pore pressure.
entifiers: *Rocky Mountain Arsenal, Denver olo).

ection pressure and volume data of the Rocky ountain Arsenal disposal well were studied to rn the physical properties of the reservoir and to rrelate reservoir properties with the earthquake story of the area. The Rocky Mountain disposal servoir contains a total fluid volume between 0.6 d 1.9 X 10 billion barrels. The total reservoir nsists of several parts which have significantly ferent fluid permeabilities. The reservoir pres-re before start of injection in 1962 was between 0 and 1400 psi subhydrostatic. After cessation of ection in 1966, the different parts of the reser-ir were at different pressures, the most permea-part having the highest pressure (about 100 psi ohydrostatic). An empirical correlation exists for injection history of the Arsenal well between mulative number of earthquakes and calculated tic reservoir pressure. A means for predicting total number of earthquakes to be anticipated fore the reservoir comes to pressure equilibrium suggested. Empirical comparison of injection ergy with earthquake magnitude shows that if in-tion energy is returned as earthquake energy, it stored for significant lengths of time before ease. If it is assumed that all injection energy has w been returned as earthquake energy, then the al energy magnitude is consistent with energy-rthquake magnitude relations proposed by chter. (Knapp-USGS)
69-07411

/DRAULIC CHARACTER OF FRACTURED ETAMORPHIC ROCKS OF THE FRONT NGE AND IMPLICATIONS TO THE ROCKY OUNTAIN ARSENAL WELL,
lorado School of Mines, Golden. Dept. of ology.
vid T. Snow.
lo School Mines Quart, Vol 63, No 1, pp 167-9, Jan 1968. 33 p, 13 fig, 27 ref.

scriptors: *Earthquakes, *Injection wells, /aste disposal, *Colorado, Hydrostatic pressure, Fractures (Geology), Faults (Geology), Groundwater basins, Aquifers, Porosity, Permeability, Transmissivity, Aquicludes, Structural geology, Pore pressure.
Identifiers: Rocky Mountain Arsenal, Denver (Colo).

Hydraulic and geometrical properties of fractured metamorphic rocks of the Front Range of Colorado are determined from damsite pressure-injection tests and records of domestic water wells. Since these same rocks beneath the Denver basin comprise the reservoir into which fluid wastes have been injected at the Rocky Mountain Arsenal Well, the Front Range properties are applicable to studies of the Arsenal well injection performance and the possible earthquake response. Fracture permeability may be of like origin in both cases: faulting, weathering and erosional stress release beneath a surface of erosion. At damsites in the Front Range metamorphic rocks, fracture spacing is about 5 to 10 ft near the ground surface, increasing to about 15 to 35 ft at the 200-ft level. Water wells intercept even fewe. significant fractures. Openings close from about 200 microns to about 70 microns between the near-surface and 200-ft depth and porosites decrease from about 0.04% to 0.001%. The logarithm of permeability decreases linearly with the logarithm of depth. The fractured aquifer is a thin skin draped over the terrane. Test data suggest that the aquifer is bounded by vanishing permeability at about 200 ft, though open fault zones may extend to greater depths. Different lithologic units have different transmissibilities. These exceed the transmissibilities deducted from Arsenal well flow, so the pre-Pennsylvanian soils and sediments resting on the gneiss at the well site may effectively confine flow to the fractured basement. (Knapp-USGS)
W69-07412

FRACTURE DEFORMATION AND CHANGES OF PERMEABILITY AND STORAGE UPON CHANGES OF FLUID PRESSURE,
Colorado School of Mines, Golden. Dept. of Geology.
David T. Snow.
Colo School Mines Quart, Vol 63, No 1, pp 201-244, Jan 1968. 44 p, 10 fig, 43 ref.

Descriptors: *Earthquakes, *Injection wells, *Waste disposal, *Colorado, Hydrostatic pressure, Fractures (Geology), Faults (Geology), Stress, Groundwater basins, Aquifers, Porosity, Permeability, Water storage, Transmissivity, Aquicludes, Structural geology, Pore pressure.
Identifiers: Rocky Mountain Arsenal, Denver (Colo).

Fractures are non-rigid fluid conductors of such small size that changes of the openings with changes of pressure result in appreciable changes of permeability and account for the major portion of storage. Plane vertical strain is assumed in the derivation of an equation of transient flow, but in radial cases, such as the Rocky Mountain Arsenal Well injection, the distributions of stress, permeability, and hydraulic potential are interrelated. A deformability coefficient for fractures in the Front Range metamorphic rocks at Bergen Park, Colorado, is deduced from strain measurements near a water-supply well which drains the fracture system. Effective stress changes consequent to fluid-pressure changes may have significance to the question of the earthquake mechanism, especially if geological evidence, such as faulting, points to a critical state of tectonic stress. From the time of latest faulting in the Denver basin probably criticality may have been maintained by erosional release of confinement, suggesting that the fractured basement is prone to failure upon injection of fluids. (Knapp-USGS)
W69-07413

HYDRODYNAMIC STUDY OF THE WESTERN DENVER BASIN, COLORADO,
Petroleum Research Corp., Denver, Colo.
Roger L. Hoeger.
Colo School Mines Quart, Vol 63, No 1, pp 245-251, Jan 1968. 7 p.

Descriptors: *Earthquakes, *Injection wells, *Waste disposal, *Colorado, Hydrostatic pressure, Potentiometric level, Fractures (Geology), Faults (Geology), Groundwater movement, Stress, Groundwater basins, Aquifers, Porosity, Transmissivity, Aquicludes, Structural geology, Pore pressure.
Identifiers: Rocky Mountain Arsenal, Denver (Colo).

The original hydrostatic pressure in the fracture system of Precambrian basement rocks in the Rocky Mountain Arsenal well was far below normal. In an effort to understand the reasons for the subnormal pressure, a study of hydrodynamic pressure gradients in overlying sedimentary rocks of the western Denver basin was considered necessary. An analysis of all available data on the major deep aquifers is presented. A barrier trend, which may be caused by a fault system of regional extent, is present between the areas of high potential and the majority of the area studied which is typically at much lower potential. (Knapp-USGS)
W69-07414

HYDROLOGY OF SOME SMALL GROUNDWATER BASINS IN IDAHO,
Idaho Univ., Moscow. Dept. of Geology.
Robert W. Jones.
Idaho Water Resources Research Institute, Termination Report, February, 1968. 7 p, 4 ref. OWRR Project A-020-IDA.

Descriptors: *Ground water, Hydrologic models, Hydrologic data, *Experimental ground water basins.

One basin has been studied (Albion basin, Cassia County, Idaho) and the results published as an open file report by the Idaho Bureau of Mines and Geology. Aquifers were delineated, water-table mapped, and preliminary evaluation of the groundwater flow pattern was obtained. Wells range in depth from 11 feet to 700 feet and yields range up 540 gpm. Clay lenses in alluvium create local artesian aquifers. The water can be classified as calcium bicarbonate type and is suitable for domestic and irrigation use. The total dissolved solids content range from 202 ppm to 2294 ppm. Hot springs exist in the Marsh Canyon area. The study should serve as a basis for further investigations utilizing experimental approaches.
W69-07459

DETAILED GROUND WATER INVESTIGATION OF MOSCOW BASIN,
Idaho Univ., Moscow. Dept. of Geology.
Robert W. Jones, and Sylvia H. Ross.
Idaho Water Resources Research Institute Research Technical Completion Report, June, 1969, Moscow, Idaho, 12 p, 3 fig, 11 ref. OWRR Project A-011-IDA.

Descriptors: *Ground water, *Basalt, *Sedimentary interbeds, *Columbia River Group, *Type area, *Small ground water basins, Field pumping tests, *Mathematical models, Artesian aquifers, *Recharge, *Storage, Coefficient of transmissibility, Coefficient of storage, *Artificial recharge, Intermittent streams, *Iron in water.

Moscow basin, a 58 square-mile, U-shaped basin with a 12 square-mile central lowland underlain by basalt flows and sedimentary interbeds of the Columbia River Group, is a type area for the study of the small ground water basins underlain by basalt that are common in the Pacific Northwest. Because field pumping tests were not practical, mathematical models of the artesian aquifers were designed. Comparison of the performance of the model aquifers with that of the real aquifers indicates that, if no recharge is taking place, ground water in storage will meet the needs of the basin until 2050 or 2100. However, values of coefficient of transmissibility ('T') and coefficient of storage

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('S') are very high in the no-recharge models. If the real values are significantly lower, then considerable recharge is taking place. No studies have been made of models that receive recharge. Model studies were used to demonstrate the feasibility of artificial recharge utilizing seasonal runoff of intermittent streams. High contents of iron in waters in parts of the artesian aquifers are the result of naturally recharging waters carrying in iron from weathered bedrock on the margins of the basin.
W69-07460

HYDROLOGY OF NEOGENE DEPOSITS IN THE NORTHERN GULF OF MEXICO BASIN,
Louisiana State Univ., Baton Rouge.
For primary bibliographic entry see Field 02L.
W69-07467

A RECONNAISSANCE OF THE GROUND-WATER GEOLOGY OF MONTVILLE TOWNSHIP, MEDINA COUNTY, OHIO,
Kent State Univ., Ohio. Dept. of Geology.
For primary bibliographic entry see Field 04B.
W69-07492

PALEOHYDROGEOLOGICAL ANALYSIS PRINCIPLES OF ARTESIAN BASINS (RUSSIAN),
Ministry of Geology.
A. N. Sultankhodzhayev, V. G. Tyminskiy, N. A. Surganova, and I. M. Rosanova.
(Geol J of Uzbek), No 1, pp 49-53, 1969. 5 p, 1 tab, 8 ref.

Descriptors: *Paleohydrology, *Analysis, *Artesian wells, *River basins, Chemical analysis, Water chemistry, Groundwater, Porosity, Hydrogen, Oxygen, Radioactivity, Mineral water, Mathematical studies, Helium, Radioisotopes, Deuterium, Chlorine, Sulfides, Aquifers, Fissures (Geology).
Identifiers: Paleohydrogeological analysis, Artesian basins.

On the basis of a formula developed by V. G. Tyminskiy and his associates (1966) and using the He/Ar method, the chemical analyses of the fresh and mineralized parts of the artesian basin waters and the relative age of these parts was made by using the aquifers of Tashkent, Fergana and Kyzyl Kum areas. The study shows that by assuming the existence of three genetic groups characterized by their chemical composition, their paleogeographic, geographic and other parameters, the paleohydrological material should be of value. It should give not only the ratio of groundwater in a mixture, but the ratio of infiltrated water in the mixture, as well. The use of the He/Ar method guarantees a reliable determination of the age of waters taking part in the mixture. (Gabriel-USGS)
W69-07500

HYDROLOGIC RESPONSE TO IRRIGATION PUMPING IN HUALAPAI FLAT, WASHOE, PERSHING, AND HUMBOLDT COUNTIES, NEVADA, 1960-67,
Geological Survey, Carson City, Nev.
For primary bibliographic entry see Field 04B.
W69-07501

GEOHYDROLOGY AND WATER UTILIZATION IN THE WILLCOX BASIN, GRAHAM AND COCHISE COUNTIES, ARIZONA,
Geological Survey, Washington, D. C.
S. G. Brown, and H. H. Schumann.
Geol Surv Water-Supply Pap 1859-F, pp F1-f32, 1969. 32 p, 7 fig, 3 plate, 2 tab, 17 ref.

Descriptors: *Water resources, *Water utilization, *Groundwater, *Arizona, Groundwater movement, Recharge, Discharge (Water), Evapotranspiration, Streamflow, Water yield, Transmissivity, Specific capacity, Hydrogeology, Groundwater basins.
Identifiers: Willcox basin (Ariz).

The Willcox basin is an area of interior drainage in Cochise and Graham Counties, Arizona. The basin comprises about 1,500 sq mi, of which the valley floor occupies about 950 sq mi. Even in areas where the consolidated rocks are fractured and jointed, only small amounts of water have been developed. The rocks of the basin consist of alluvium, in which lenticular sand and gravel layers interbedded in silt-and clay-size material constitute the principal aquifer. The median specific capacity of wells ranges from 7.4 to 20 gpm/100 ft of saturated material penetrated. The coefficient of transmissibility of the aquifers ranged from 58,000 to 160,000 gpd/ft. The estimate of the evapotranspiration in the playa area before large-scale development was about 75,000 acre-ft/yr. Underflow toward the playa was computed to be about 54,000 acre-ft/yr. Ground water has been used for irrigation since 1910. In 1928, about 4,000 acre-ft of groundwater was pumped, and by 1963 180,000 acre-ft/yr was being pumped. Water-level declines for 1962-63 exceeded 10 ft/yr in some wells in the more heavily pumped Kansas Settlement area and 7 ft/yr in the Stewart area. (Knapp-USGS)
W69-07506

REGIONAL HYDROGEOLOGY OF THE NAVAJO AND HOPI INDIAN RESERVATIONS, ARIZONA, NEW MEXICO, AND UTAH,
Geological Survey, Washington, D. C.
M. E. Cooley, J. W. Harshbarger, J. P. Akers, W. F. Hardt, and O. N. Hicks.
Geol Surv Prof Pap 521-A, pp A1-A61, 1969. 61 p, 20 fig, 5 plate, 8 tab, 124 ref.

Descriptors: *Hydrogeology, *Water resources, *Groundwater, *Arizona, *New Mexico, Colorado, Utah, Groundwater movement, Recharge, Discharge (Water), Transmissivity, Permeability, Specific capacity, Aquifers, Water wells, Water quality, Hydrologic data, Water levels.
Identifiers: Navajo-Hopi Indian reservation.

The Navajo and Hopi Indian Reservations have an area of about 25,000 sq mi and are in the south-central part of the Colorado Plateaus. The underlying sedimentary rocks range in age from Cambrian to Tertiary and the Igneous and metamorphic basement rocks are of Precambrian age. The climate varies widely, ranging from semiarid below 4,500 ft to relatively humid above 7,5000 ft. Precipitation has a strong and fairly uniform relation to altitude. The Colorado and San Juan Rivers are perennial, but most of other streams are ephemeral or intermittent. Nearly 1/6 of the area drains internally. The aquifers are composed of beds of sandstone and mudstone. The main aquifers are in the Coconino Sandstone, Navajo Sandstone, and the alluvium; but all other units locally yield some water to wells and springs. Coefficients of permeability are generally less than 10 gpd per sq ft, and many are less than 3 gpd per sq ft. Yields from wells in these aquifers usually are less than 25 gpm. Most specific capacities computed from tests of wells range from 0.3 to 5.0 gpm per ft of drawdown. The dissolved-solids content of 1,300 water samples analyzed ranges from 90 to more than 25,000 ppm. Water having the greatest amount of dissolved solids is in deep aquifers in the Black Mesa and San Juan basins. (Knapp-USGS)
W69-07512

WATER RESOURCES OF WINDWARD OAHU, HAWAII,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
W69-07516

BIBLIOGRAPHY OF HYDROLOGY OF THE UNITED STATES AND CANADA,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
W69-07517

GEOLOGY AND GROUND-WATER RESOURCES IN THE RALEIGH AREA, NORTH CAROLINA,
Geological Survey, Raleigh, N. C.
V. Jeff May, and J. D. Thomas.
NC Dep Water Resources Ground Water Bull 15, Nov 1968. 135 p, 26 fig, 32 tab, 23 ref.

Descriptors: *Water resources, *North Carolina, *Groundwater, Water wells, Water yield, Aquifers, Fractures (Geology), Permeability, Discharge (Water), Data collections, Hydrologic data, Water quality, Water levels.
Identifiers: Raleigh Area (NC).

Several towns and industries in the Raleigh area, N. C. obtain their water supplies from wells. Groundwater is the source for all private supplies. The permeability of the rock units depends largely upon the occurrence of secondary interstices such as fractures and cleavage planes. Because the nature and abundance of these interstices vary in the different rock types, the yields of wells differ greatly from place to place. The yield of wells in all of the metamorphic and igneous rocks, except greenstone, ranges from 12 to 22 gpm. Adequate domestic supplies and small to moderate industrial and municipal supplies are obtained from these rocks. Most wells in Triassic rocks yield less than 10 gpm. The average yield of wells in drawsgreater than twice the average yield of wells in other topographic locations. The permeability of the rocks decreases with depth. Generally, little water is contained in the rocks below a depth of 200 to 250 ft. Groundwaters in the Raleigh area are mostly calcium and sodium bicarbonate type waters. Some highly mineralized waters for this area are produced from the Triassic and metavolcanic rocks. The bromide concentration in groundwater is probably from residual sea water. The wells waters containing above-normal amounts of nitrate in the area have been polluted because of improper well casing. (Knapp-USGS)
W69-07519

KARSTIC PHENOMENA (FRENCH).
P. Fenelon.
Mem et Doc, Centre Rech et Doc, Cartogr Geogr, NSF, Paris, France, Vol 4, New Ser, 1968, 378 p. Texts in French.

Descriptors: *Karst, *Mapping, *Hydrologic properties, Maps, Geomorphology, Carbonates, Water chemistry, Geology, Calcium compounds, Dissolved solids, Topography, Tropical regions, Temperate.
Identifiers: Karstic phenomena.

This book is a comprehensive report on the karst phenomena and consists of 14 articles as follows: (1) French vocabulary of karstic phenomena; (2) large scale maps of karstic phenomena; (3) Cam de Caylus map of karstic phenomena; (4) plains Verdon map of karstic phenomena; (5) geomorphologic map of the Caussols, Calern, and La Malle plateaus; (6) carbonate chemistry and karstic hydrology; (7) the origin of decalcification clays; (8) karstic morphology of the eastern part the Monts de Vaucluse; (9) dissolution curve calcareous rocks in the mountains of the Mediterranean area; (10) eastern Mediterranean karst phenomena; (11) the depressions of the Central Moroccan Atlas; (12) the development of karst relief in tropical and temerate regions; (13) geomorphological notes on karstification of Barbados (Antilles); and (14) the morphology of calcareous areas of Jamaica and Puerto Rico.
(Gabriel-USGS)
W69-07552

BASE OF FRESH GROUND WATER IN SOUTHERN OKLAHOMA,
Geological Survey, Washington, D. C.
Donald L. Hart, Jr.
Geol Surv Hydrol Invest Atlas HA-223, 2 sheets, 1966. Text, 5 map, 4 charts.

scriptors: *Groundwater, *Saline water-freshter interfaces, *Oklahoma, Brines, Water quali- Water yield, Water wells, Aquifers, Permeabili- Recharge, Groundwater movement.
ntifiers: Saline groundwater.

e altitude of the base of fresh groundwater in thern Oklahoma is shown by maps and cross tions in a 2-sheet hydrologic atlas. The base of h water was determined from electric logs of p wells, drillers' logs of water wells, and from lished reports. Its depth varies from within a feet of the surface to over 3000 ft below the face, and depends on the depth of the rocks, ir permeability and solubility and source of harge. Areas of deepest fresh water occur in derately to steeply dipping permeable rocks h large recharge capability. In poorly permeable ks, the fresh water-salt water interface is sharp, in more permeable rocks there is a broad dational zone. (Knapp-USGS)
9-07553

NUMERICAL TECHNIQUE FOR AQUIFER ALYSIS,
ois Univ., Urbana; and Nova Scotia Dept. of es, Halifax.
. Bredehoeft, and George F. Pinder.
c, Nat Symp Anal Water-Resource Syst, pp , Denver, July 1968. 1 p.

scriptors: *Numerical analysis, *Analytical hniques, *Aquifers, Aquifer characteristics, undwater movement, Mathematical models, ital computers, Pumping, Water distribution plied), Water levels, Regional analysis.
ntifiers: Differential equations, Nova Scotia.

summary of a report on mathematical model ch determined the flow characteristics of an ifer was given. The unsteady flow of ground- er in an aquifer was described by elliptic and abolic partial-differential equations which could approximated by finite equations. The solution the finite difference equations for a non- nogeneous, anisotropic, leaky-artesian aquifer n irregular boundaries, differing boundary con- ons, and multiple variable-rate pumping (or harge) wells was discussed. The method used solving the equations in two-space dimensions n time was the alternating direction implicit nique. Several comparisons of the numerical tions versus analytical solutions were sented. Results of a digital analysis of an aquifer Musquodoboit Harbor, Nova Scotia, were sented. Several other applications were listed. It concluded that the numerical technique made sible rapid analysis of groundwater flow ems, and to use such models as a base from ch to optimize the total system. For main entry W69-07562. (Gysi-Cornell)
9-07569

i. Water in Soils

E ASPHALT MOISTURE BARRIER FOR RMING DROUGHTY SOILS,
rnational Harvester Co., Chicago, Ill. Product ning Research; and American Oil Co., Whit- Ind. Research and Development Dept.
primary bibliographic entry see Field 03B.
9-07344

EPENDENT MEASUREMENT OF MATRIC D OSMOTIC POTENTIAL OF SOIL WATER,
icultural Research Service, Riverside, Calif. nity Lab.
. Oster, S. L. Rawlins, and R. D. Ingvalson.
Sci Soc Amer Proc, Vol 33, No 2, pp 188-192, -Apr 1969. 5 p, 3 fig, 15 ref.

criptors: *Osmotic pressure, *Water chemistry, lutes, Moisture stress, Density, Soil water ement, Diffusion, Instrumentation, Tensiome- , Moisture tension.
ntifiers: Matric potential (Soil water), Salt ex- ion, Psychrometry.

A technique is described that uses the operating principles of the thermocouple psychrometer and the porous plate apparatus to measure the matric and osmotic potentials of soil water without extraction of a significant amount of soil solution. The technique was tested on a Na-saturated Gila soil to which NaCl solutions with osmotic potentials of -1, -2, and -6 bars were added. The standard error of measurement of the soil water potential components was about 0.04 bar. The measured osmotic potentials of the soil were lower than those of the added solutions, which can be explained by salt exclusion although mineral dissolution could contribute to these results. The technique also permitted measurement of the partial molar volume of soil water with an accuracy of about 1%. Within this precision, the partial molar volume of soil water in this study was shown to be the same as that of pure water. (Knapp-USGS)
W69-07374

EVALUATING RANGELAND WATER QUALITY WITH SMALL PLOT INFILTROMETERS,
Utah State Univ., Logan. Dept. of Watershed Science; and Intermountain Forest and Range Experiment Station, Ogden, Utah.
For primary bibliographic entry see Field 03F.
W69-07377

EFFECTS OF SOIL PHYSICAL PROPERTIES, RAINFALL CHARACTERISTICS, AND WIND VELOCITY ON CLOD DISINTEGRATION BY SIMULATED RAINFALL,
Agricultural Research Service, Manhattan, Kans. Div. of Soil Erosion.
Leon Lyles, L. A. Disrud, and N. P. Woodruff.
Soil Sci Soc Amer Proc, Vol 33, No 2, pp 302-306, Mar-Apr 1969. 5 p, 4 fig, 9 tab, 9 ref.

Descriptors: *Infiltration, *Rainfall-runoff relationships, *Impact (Rainfall), *Puddling, *Soil structure, *Simulated rainfall, *Wind velocity, Soil texture, Runoff, Erosion, Permeability, Rainfall simulators, Hydraulic models.
Identifiers: *Clod disintegration, Raindrop energy.

The effects of clod size and density, rainfall intensity and duration, and wind velocity on clod disintegration by simulated rainfall were studied in a laboratory wind tunnel-raintower facility. Significant interactions (including those of higher order) were found among the variables studied. Clod bulk density had a minor effect on disintegration. For a specific clod size and wind velocity, 10-min rains at 5.61 cm/hr were about as destructive as 90-min rains at 1.60 cm/hr, even though the total volume of rainfall was 2.5 times larger in the latter case. Wind-driven rain was very effective in clod disintegration. Up to 66% more soil was lost from clods exposed to 13.4-m/sec winds than those exposed to no wind for the same rain intensity, duration of exposure, and clod size. Mean drop size striking the clods probably increases with wind velocity and would account for some of the wind effects. Small clods were more susceptible to disintegration by raindrop impact than large clods. Multiple regression analyses indicate about 80 and 89% of the soil detachment variance was accounted for by linear and curvilinear procedures respectively. (Knapp-USGS)
W69-07378

PIEZOMETER DETECTION OF SATURATED INTERFLOW IN SOILS,
Tennessee Valley Authority, Knoxville.
For primary bibliographic entry see Field 07B.
W69-07463

HYDROLOGY OF NEOGENE DEPOSITS IN THE NORTHERN GULF OF MEXICO BASIN,
Louisiana State Univ., Baton Rouge.
For primary bibliographic entry see Field 02L.
W69-07467

2H. Lakes

POTENTIAL POLLUTIONAL EFFECTS IN DEEP LAKES,
Environmental Control Administration, Cincinnati, Ohio.
For primary bibliographic entry see Field 05C.
W69-07363

PLANKTONIC AND BENTHIC BACTERIA OF LAKES AND PONDS,
Windham Coll., Putney, Vt.
Louise F. Potter.
Proc Rudolfs Res Conf, Rutgers Univ, New Brunswick, NJ. Principles and Applications in Aquatic Microbiology, Heukelekian, H and Dondero, Norman C (eds), John Wiley and Sons, New York, pp 148-166. 11 tab, 22 ref, disc.

Descriptors: *Plankton, *Bacteria, *Benthic flora, *Aquatic environment, Water, Mud, Surfaces, Storage, Irrigation water, Lakes, Ponds, Alkaline water, Fish, Plants, Algae, Depth, Chlorophyll, Ammonium compounds, Vitamin B, Spores, Amino acids, Yeasts, Soil water.
Identifiers: Aufwuchs group, Montana, Flathead Valley, Mission Valley, Chromogen, Stone, Gram stain, Carex sp, Potamogeton sp, Sedge, Arthrobacter.

Planktonic and benthic populations differ morphologically, especially in Gram reactions. Size and proportion of organism types in each group vary with environment changes. The Aufwuchs group, growing on stones, stumps, plants, and fish, resembles the planktonic more than the benthic. Bacteria in lakes (oligothrophic and eutrophic) and ponds (eutrophic or dystrophic) are compared. Surface water showed large fluctuations in the number of bacteria in proportion to chromogens. Areas within lakes, rather than lake types (oligotrophic or eutrophic) appeared significant. Benthic bacterial populations are in inverse proportion to depth of water above mud. Indications are that bacteria do not decompose materials as rapidly as they are being deposited. There seem to be autochthonous floras for water and mud. Although no distinct patterns of vertical distributions emerge, the surface contains the largest populations. Chromogens predominate at all levels. Red-pigmented and pink-pigmented organisms were most numerous in surface water. Gram-positive spore-formers were more frequent in mud than in water. Fish are carriers of bacteria. The alkalinity, inorganic and organic compounds, including vitamins, affect bacterial populations, B vitamins increasing the percentage of chromogens. Percentage of chromogens was an indicator of the planktonic group. For main entry see W69-07423. (Jones-Wisc)
W69-07432

THE ECOLOGICAL ROLE OF PHOSPHORUS IN WATERS WITH SPECIAL REFERENCE TO MICROORGANISMS,
Dalhousie Univ., Halifax, Nova Scotia. Dept. of Biology.
For primary bibliographic entry see Field 05C.
W69-07435

THE EXCHANGE OF DISSOLVED SUBSTANCES BETWEEN MUD AND WATER IN LAKES,
Freshwater Biological Association, Ambleside (England).
Clifford H. Mortimer.
Journal of Ecology, Vol 29, pp 280-329, 1941. 21 fig, 2 tab.

Descriptors: *Mud, *Sediment-water interfaces, *Lakes, *Water chemistry, Reduction (Chemical), Oxidation, Adsorption, Aeration, Anaerobic conditions, Hypolimnion, Nutrients, Diffusion, Water

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transfer, Iron, Ammonia, Phosphates, Oxygen, Color, Alkalinity, Eutrophication, Cycling nutrients.
Identifiers: *Mud-water exchange, Esthwaite water, Dissolved ions, Reduction potential, Artificial mud-water systems, Chemical stratification, Isopleths, Time-depth diagrams, Concentration gradient, Overturn.

Distribution of physical variables and dissolved substances in Esthwaite by depth-time are diagrammed. Vertical chemical stratification in water column suggests that main agents of production or depletion are located at mud's surface. Movement of water masses in hypolimnion is mainly horizontal and sufficient to maintain eddy diffusion coefficient and spread rate of dissolved substance exceeding molecular diffusion by 2000-fold. Hypolimnion activity in Esthwaite suggests an applicable hypothesis to lakes in which deoxygenation occurs. Oxygen depletion triggers nitrate reduction at an early stage. A second stage at redox approximately E-sub-7x 0.25 volt destroys insoluble ferric complexes existing at mud-water interface and liberates bases, including ammonia, ferrous iron, and other reducing materials. At third stage, ion concentrations increase gradually until oxygen is reintroduced at overturn. Depth-time of redox potential and electrical conductivity from two artificially aerated and anaerobic mud-systems were diagrammed to compare variations in dissolved substances. After oxidized surface layer disappeared in anaerobic tank, rapid rise in iron, ammonia, silicate, phosphate, alkalinity and conductivity occurred. In aerated tank, little change occurred in concentrations of dissolved substances apart from accelerated decrease of pH, alkalinity, nitrate, and ammonia, and subsequent slow rise in sulfate and conductivity. (Bortleson-Wisc)
W69-07438

A THREE DIMENSIONAL STUDY OF PARAMETERS RELATED TO THE CURRENT DISTRIBUTION IN LAKE ROOSEVELT,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
Robert T. Jaske, J. C. Sonnichsen, and C. A. Oster.
Battelle Memorial Inst NW Lab Res Rep to OWRR, Dept of Interior, Apr 23, 1969. 93 p, 35 fig, 10 tab, 32 ref, 5 append. AEC Contract No. AT (45-1)-1831. Available from Clearinghouse as PB 184 700 at $3.00 in paper copy and $0.65 in microfiche.

Descriptors: *Lakes, *Reservoirs, *Currents (Water), *Density stratification, *Mathematical models, Computer programs, Density, Temperature, Turbulence, Current meters, Data collections, Remote sensing, Streamflow, Operations research, Systems analysis.
Identifiers: *Lake Roosevelt (Wash), Jet currents, Savonious current meter.

Research was undertaken to describe the physical relationship of the current field to the stratification pattern in Lake Roosevelt. The higher temperatures in the penstock discharge were related to the mean temperature of water in the entrance flow field. This condition persists for many miles upstream so that the mean temperature of the moving water mass is represented by a temperature from 10 to 20 m above the location of maximum current speed. A correlation of the position of the depth of the jet with the densimetric Froude number was obtained. The use of the Savonious rotor current meter was demonstrated to be appropriate for the flow field under study, with current speeds of from 0.025 to 0.35 knots. Second order instabilities in the current speeds were determined and standard deviation estimated, but no theory supporting the existence of these instabilities was advanced. A 2-dimensional, semi-empirical mathematical model was developed as a basis for further operations research. The relationship of the flow field at Lake Roosevelt to that of the Arrow Lakes was detailed, and distinct similarities were noted in portions of similar depth. A theory is proposed to guide computations of the depth of the flow field involved in the travel of surface water over a spillway or submerged obstacle. Computer program listings are included. (Knapp-USGS)
W69-07481

A NONLINEAR MODEL OF THE FLOW OF AN INHOMOGENEOUS FLUID AT THE EQUATOR (RUSSIAN),
Akademiya Nauk SSSR. Institut Okeanologii.
For primary bibliographic entry see Field 02A.
W69-07529

2J. Erosion and Sedimentation

LANDWARD TRANSPORT OF BOTTOM SEDIMENTS IN ESTUARIES OF THE ATLANTIC COASTAL PLAIN,
Geological Survey, Woods Hole, Mass.
For primary bibliographic entry see Field 02L.
W69-07380

CONSOLIDATION AND CEMENTATION OF RECENT SEDIMENTS IN THE ATCHAFALAYA BASIN,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
Clara Ho, and James M. Coleman.
Geol Soc Amer Bull, Vol 80, No 2, pp 183-191, Feb 1969. 9 p, 5 fig, 2 plate, 6 ref.

Descriptors: *Sedimentation, *Diagenesis, *Consolidation, *Compaction, *Louisiana, Mississippi River Basin, Density, Porosity, Permeability, Analytical techqniques, Fluorometry, X-ray diffraction, X-ray fluorescence, Spectrophotometry, Nitrogen, Carbonates, Organic matter.
Identifiers: Atchafalaya River Basin (La).

X-ray radiography was utilized extensively in examining core slabs from a fresh-water clay sequence in the Atchafalaya River Basin, Louisiana. From the radiographs, detailed diagenetic features such as cementation by secondary precipitated minerals, pyrite and carbonate replacement of organic fragments, and progressive formation of nodules were revealed. Selected samples were analyzed by means of differential thermal analysis, X-ray diffraction, X-ray fluorescence, atomic absorption spectrophotometry, Kjeldahl method for total nitrogen and wet combustion for organic carbon. The diagenetic mineral accumulations consisted of calcium carbonate, ferric oxide, ferrous carbonate, and Mg and Mn compounds of unknown nature and have contributed significantly to the observed strength increase with depth. The dewatering process, commonly attributed solely to compaction resulting from overburden, may also be brought about by a gradual replacement of the pore-water space by secondary mineral accumulation. (Knapp-USGS)
W69-07385

EXPERIMENTS ON FORMATION OF CONTORTED STRUCTURES IN MUD,
Geological Survey, Denver, Colo.; and Geological Survey of Israel, Jerusalem.
Edwin D. McKee, and Moshe Goldberg.
Geol Soc Amer Bull, Vol 80, No 2, pp 231-243, Feb 1969. 13 p, 8 plate, 2 tab, 41 ref.

Descriptors: *Sedimentary structures, *Mud, *Load distribution, Compaction, Silts, Faults (Geology), Movement, Diagenesis, Deposition (Sediments), Sedimentation, Model studies, Laboratory tests.
Identifiers: Contorted bedding.

Contorted structures can be formed in mud or sand as a result of differential loading. Experiments were conducted in water tanks to test various factors of possible significance in the contortion of mud by loading. The most significant of 6 factors tested was distribution of load, but others affecting the type of structure under certain conditions were the manner of depositing the mud, the form of the underlying surface, the direction of loading, and the m
ment or lack of movement of water during loa
Organic material was shown to be unnecessa
forming conical structure or convolute bed
Strength of base had little or no influence on
volute-structure development. Contortions ra
from the simple anticlinal type with vertical a
plane, commonly referred to as convolute, to st
tures with gently dipping axial planes, to ot
with lateral extensions or 'flames' from the ape
and, finally, to those with complex overtur
folds. Causes of these variations were determi
in terms of the factors listed. Some additional fo
of contorted bedding result from other type
penecontemporaneous deformation such as slu
ing from undermining or from oversteepening,
ferential lateral movement, and surface drag; th
forms differ from those structures formed by lo
ing.
W69-07386

SUBMARINE END MORAINES AND SOCIATED DEPOSITS ON THE SCOTI SHELF,
Bedford Inst., Dartmouth (Nova Scotia). Atla
Oceanographic Lab.
Lewis H. King.
Geol Soc Amer Bull, Vol 80, No 1, pp 83-96, 1969. 14 p, 7 fig, 2 plate, 15 ref.

Descriptors: *Glacial drift, *Continental sh
Marine geology, Geomorphology, Aquifers, Se
ments, Sedimentation.
Identifiers: *Canada, End moraines, Scotian She

A submarine end-moraine complex occurs on
Scotian Shelf south and east of Halifax at 30 to
km offshore. It extends as a belt of low ridges wh
lies parallel to the present coast. Some of the lar
individual ridges extend up to 55 km in length, w
a slight arcuate pattern, and are an average of 5
in height above the underlying bedrock. The
extent of the system has not been determined; ho
ever, a cursory examination indicates its occure
along at least 500 km of the coast, in water dep
ranging from 70 to 200 m. The moraine patter
not revealed on the published bathymetric ch
because the ridges are to a large degree sub-bott
features, masked by ponded clay and silt depos
However, the extreme peaks of some ridges
crop out slightly above the clay and silt of the b
tom, so that their pattern must be resolved
detailed geologic mapping. The materials form
the exposed portions of the ridges range from r
tively unaltered to completely reworked gla
debris, depending on the depth of water in wh
they occur. Resolution of the moraine pattern
greatly enhanced when the ridges are mapped
sub-bottom features, using high-frequency ec
grams obtained at closely spaced intervals.
degree of penetration with such an echo-sounde
limited essentially to the base of the clay, but
full profile of the moraines above the underly
bedrock is revealed by low-frequency, continu
seismic reflection profiles. Sub-bottom records a
textural data on bottom samples indicate the occ
rence of stratified proglacial deposits associa
with the moraines. (Knapp-USGS)
W69-07393

CLAY MINERALS OF THE COLUMBIA RIVE A QUALITATIVE, QUANTITATIVE, A STATISTICAL EVALUATION,
Washington Univ., Seattle. Dept. of Oceanograp
H. J. Knebel, J. C. Kelly, and J. T. Whetten.
J Sediment Petrol, Vol 38, No 2, pp 600-611, J
1968. 12 p, 7 fig, 4 tab, 11 ref. Nonr 477 (37), A
(45-1)-1725, GP-3591.

Descriptors: *Sedimentology, *Clays, *Colum
River, Mineralogy, Provenance, Weathering, Se
ment transport, Statistical methods, Correlati
analysis.
Identifiers: Discriminant analysis.

The relative amounts of montmorillonite, illite, a
chlorite-kaolinite in the bottom sediments w

considerably between the reservoirs of the Columbia River. The relative fractions of montmorillonite increase progressively downstream; illite shows an inverse trend; the amounts of chlorite-kaolinite remain consistently low throughout the river. Discriminant function analyses indicate significant differences in 3 areas of the Columbia River based on the variability of clay minerals in 6 groups of samples from reservoirs: Grand Coulee in the upper reaches, Rocky Reach, Wanapum, and Priest Rapids in the min-reaches, and Bonneville, Dalles, McNary, and Ice Harbor in the lower reaches of the river. Samples from tributaries of the lower Columbia River differ significantly from all other groups. The presence and distribution of 2 distinct types of weathering environments within the Columbia River Basin may account for some of the agreement between observed clay mineral fractions and those predicted from source area evaluations, and they may confirm the reliability and sensitivity of the discriminant analysis in distinguishing between 2 groups on the basis of clay mineral variability. The use of the discriminant function analysis in clay mineral studies is potentially valuable for vertical as well as horizontal correlation. (Knapp-USGS)
W69-07409

TIDAL STREAM ACTION AND SEA LEVEL CHANGE AS ONE CAUSE OF VALLEY MEANDERS AND UNDERFIT STREAMS,
Newcastle Univ. (Australia). Dept. of Geography.
For primary bibliographic entry see Field 02L.
W69-07417

TIDAL FLAT SEDIMENTATION ON THE COLORADO RIVER DELTA, NORTHWESTERN GULF OF CALIFORNIA,
Humboldt State Coll., Arcata, Calif.
Robert Wayne Thompson.
Geol Soc Amer Mem 107, 1968. 133 p, 35 fig, 25 plate, 16 tab, 64 ref, 1 append. API Project 51.

Descriptors: *Deltas, *California, *Sedimentation, *Colorado River, Alluvial channels, Currents (Water), Tides, Waves (Water), Winds, Coasts, Flood plains, Sedimentology, Sands, Silts, Tidal marshes.
Identifiers: Baja California (Mex), Tidal flats.

Barren mud and salt flats form a low-lying coastal plain at the northwestern end of the Gulf of California. The region is arid, and characterized by a maximum spring tide range of 8 to 10 m. The sequence of sediment types includes chaotic muds and evaporites, moderate brown, well-laminated clayey silts, brown to gray mottled silty clays, and gray, poorly laminated silty clays and clayey silts. The silts and clays are derived from suspended load of the Colorado River, and are carried to the site of deposition by Gulf tidal currents. The high mud flats developed by depositional regression. Mud supply diminishes toward the south, and wave effects are accentuated accordingly. Coarse sand is carried northward to form prominent longshore spits which finger out into the intertidal muds. Sediment supply has been much reduced for the past 50-60 yr due to diversion of the Colorado River into the Salton Sea and the subsequent construction of Hoover Dam. Consequently, waves have winnowed the poorly segregated mud-flat deposits, piled coarse mollusk remains into beach ridges fringing the northern high flats, and developed a fine sand and shell veneer over the intertidal zone. Older beach ridges, now largely encased by intertidal muds, record an earlier period of low mud supply and reworking which was probably initiated 1000 to 1500 years B.P. by diversion of the Colorado River into the Salton Basin to the north. (Knapp-USGS)
W69-07422

EROSION CONTROL AT HOLLINGER MINE TAILING SITE,
Hollinger Consolidated Gold Mines Ltd., Timmins (Ontario).
J. M. Gordon.
Can Mining J, Vol 90, No 6, pp 46-50, June 1969. 5 p, 5 photo, 1 tab.

Descriptors: *Erosion control, *Planning, *Plant growth, Grasses, Trees, Sludge, Sewage disposal, Cost analysis, Moisture, Seasonal, Slopes, Swamps.
Identifiers: *Canada, Tailings erosion control, Canadian mine-erosion control.

The best method of protection from erosion of the Hollinger Mine tailings was investigated by planting grass and trees (poplar, jackpine, black spruce, etc.) on the slopes and plateau of the tailing deposit of 70 to 90 ft above the original low-lying ground. The article contains the following brief chapters: (1) long-term planning; (2) erosion control of slopes; (3) erosion control of the plateau; (4) description of grasses; (5) method of seeding and seed mixture; (6) method of planting trees and type of nursery stock used; and (7) concluding remarks. The results of the application of grass and tree planting to the tailings deposit can be considered as entirely satisfactory because grasses and trees are growing on the slopes and the 100-ft-high plateau is gradually becoming parkland. (Gabriel-USGS)
W69-07489

DYNAMIC DIVERSION: INFLUENCE OF LONGSHORE CURRENT-TIDAL FLOW INTERACTION ON CHENIER AND BARRIER ISLAND PLAINS,
California Univ., Davis. Dept. of Geology; and California Univ., Bodega Bay, Calif. Bodega Marine Lab.
For primary bibliographic entry see Field 02L.
W69-07525

SEDIMENTARY PROCESSES OPERATIVE ALONG THE WESTERN LOUISIANA SHORELINE,
Continental Oil Co., Ponca City, Okla.
For primary bibliographic entry see Field 02L.
W69-07526

ORGANIC MATTER IN THE GLACIOMARINE SEDIMENTS OF THE EASTERN ANTARCTIC,
Akademiya Nauk SSSR. Institut Geologii i Razrabotki Goryuchikh Iskopaemykh.
O. K. Bordovskiy.
Oceanology of the Academy of Sciences of the USSR, AGU, Washington, D. C., Vol 8, No 1, pp 54-60, 1968. 7 p, 1 fig, 3 tab, 13 ref.

Descriptors: *Antarctic, *Glacial drift, *Glaciers, *Sediment transport, *Organic matter, Sands, Clays, Bituminous material, Humus, Icebergs, Benthic fauna, Biomass, Nitrogen, Oxygen.
Identifiers: Eastern Antarctic, Glaciomarine Antarctic sediments.

Distribution and composition of organic matter in the recent glaciomarine Antarctic sediments is analyzed on the basis of the analysis of samples collected by the first Soviet Antarctic expedition on the Motor Vessel Ob; and using earlier publications. The study shows that the organic matter of glaciomarine sediments of eastern Antarctic is typified by a number of features also found in the organic matter of other marine sediments. Some specific features affecting the Antarctic bitumens are apparently due to the nature of sedimentation, namely the dominant role of benthic filter-feeding organisms in the sedimentation of organic matter. (Gabriel-USGS)
W69-07528

NATURAL AND MAN-MADE EROSION IN THE HUMID TROPICS OF AUSTRALIA, MALAYSIA AND SINGAPORE,
Hull Univ. (England). Dept. of Geography.
Ian Douglas.
Comm of Surface Waters, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 75, pp 17-30, 1967. 14 p, 6 fig, 6 ref.

Descriptors: *Erosion, *Tropical regions, *Rain forests, Humid climates, Weathering, Residual soils, Accelerated erosion, Floods, Sediment yield, Hydrogeology.
Identifiers: *Australia, *Malaysia, *Singapore.

Under natural rain forest conditions in the humid tropics there is a striking contrast between the great depth of weathered rock material and soil, often exceeding 30 m, and the very small concentrations of suspended and dissolved matter carried in stream waters. The dense forest vegetation which exists in a delicate ecological balance with the soil, exerts a protective effect against mechanical processes such as raindrop splash and slope wash, but favors the chemical attack on minerals. Variations in the nature of the vegetation cover affect the rate of erosion under natural conditions. Once the vegetation is removed the rate of erosion is greatly increased. Comparisons between rates of erosion determined on headwater streams, where interference is minimal, and at stations further downstream, where considerable human activity affects river behavior, are used to illustrate the effects of forestry, grazing, tree crops, cultivation, mining, and urban development. A great volume of erosion occurs during the construction stage when large areas of soil are left exposed to the effects of splash and surface runoff. These conditions provide very rapid rates of runoff to streams, producing much higher flood peaks than occur natural under conditions with consequent damage to stream banks and riverine structures. More permanent are the effects of changes in land use of river regimes and on the course of erosion. With increasing human occupance of the catchment areas of the humid tropics, erosion becomes concentrated into short duration flood events which may cause disruption to river users and flood plain dwellers in the lower parts of the catchment areas. (Knapp-USGS)
W69-07539

EROSION OF GRANITE TERRAINS UNDER TROPICAL RAIN FOREST IN AUSTRALIA, MALAYSIA AND SINGAPORE,
Hull Univ. (England). Dept. of Geography.
Ian Douglas.
Comm of Surface Waters, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 75, pp 31-40, 1967. 10 p, 1 tab, 8 ref.

Descriptors: *Erosion, *Weathering, *Tropical regions, Rain forests, Humid climates, Residual soils, Sediment yield, Hydrogeology, Water quality, Water chemistry.
Identifiers: *Australia, *Malaysia, *Singapore.

Observations of streams draining tropical rain forest covered granite catchments in Singapore, West Malaysia, and Northeast Queensland, Australia reveal that while dissolved solids concentrations and suspended sediment concentrations are always low (usually less than 50 ppm and 100 mg/l respectively) the total loads carried by streams under natural, undisturbed conditions may be fairly high, up to 100 cu m/sq km/yr when the mean annual rainfall is around 4,000 mm. Despite the common assertion that the humid tropical environment favors chemical weathering, more of the total load evacuated from the catchments studied is carried as suspended matter than in solution, because of the supply of fine colloidal clay particles to the streams by subsurface movement of drainage water in the soil profile and by the undercutting of stream banks. Small streams containing a lot of organic matter, and probably deriving most of their flow from groundwater and soil water have a pH between 5.7 and 6.4, whereas those flowing more rapidly with sandy or boulder beds have a pH between 6.5 and 7.5. Silica is the main dissolved constituent, concentrations varying from 6 to 32 ppm, depending on discharge and on the degree of incision of the stream channel into the deep mantle of weathered rock. The more readily soluble materials such as calcium and magnesium form a higher proportion of the dissolved content of drainage waters than of the rock from which they

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are derived, demonstrating their preferential removal from the granite. (Knapp-USGS)
W69-07540

BED LOAD TRANSPORT AT FLOOD TIME,
Szkola Glowna Gospodarstwa Wiejskiego, Warsaw (Poland). Dept. of Hydraulics Engineering.
J. Skibinski.
Comm of Surface Waters, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 75, pp 41-47, 1967. 7 p, 4 fig, 8 ref.

Descriptors: *Sediment transport, *Bed load, *Floods, Streams, Non-uniform flow, Hydraulic models, Flumes, Sedimentation rates, Sediment discharge, Sedimentology.
Identifiers: Flood wave, Bed load transport.

With the same flow volume, the intensity of bed load transport is greater in the rising phase of the flood wave than in the falling phase. This affects bed load calculations for floods and total bed load tranport. Tests were made in a flume 23 m long and 0.60 m wide, with a sand bed 0.25 m deep. The sand-grain representative diameter was 0.414 mm. Water flow varied between 0.009 to 0.120 cu m/sec. Mean velocities were from 0.088 to 0.795 m/sec with water depths from 0.05 to 0.40 m. Tests were run with rising wave to falling wave ratios of 1:1.93 and with constant water depths of 0.10 to 0.40 m. Formulae were derived relating bed load transport to velocity and water depth. Results of tests are shown grapically. (Knapp-USGS)
W69-07541

EFFECT OF RECENT CRUSTAL MOVEMENTS ON THE SHAPE OF LONGITUDINAL PROFILES AND WATER LEVELS IN RIVERS,
Akademiya Nauk URSR, Kiev. Instytut Geologichnykh Nauk.
N. G. Volkov, I. L. Sokolovsky, and A. I. Subbotin.
Comm of Surface Waters, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 75, pp 105-116, 1967. 12 p, 5 fig.

Descriptors: *Erosion, *Degradation (Stream), *Land subsidence, Geomorphology, Structural geology, Terrain analysis, Profiles, Water levels.
Identifiers: Tectonic movements, Geologic uplift.

Breaks in the longitudinal profiles of streams may be caused by tectonic movements as well as by the influence of tributaries or the composition of the rocks the river is eroding. To calculate the effects of tectonic movements, a theoretical profile of the river shape may be calculated and compared with the actual shape. With a long enough record, changes in stage at constant discharge give a measure of degradation or aggradation caused by uplift or subsidence. An analysis of discharge data from over 130 gaging stations in the USSR shows that crustal movement calculated by degradation rate compares with the rate of recent crustal movements obtained by surveying methods. (Knapp-USGS)
W69-07543

THE PATTERN OF SEDIMENT MOVEMENT IN THE RIVER TYNE,
Department of Water Resources (England). Devon River Authority.
For primary bibliographic entry see Field 02L.
W69-07544

COARSE BEDLOAD AS A FACTOR DETERMINING BED SLOPE,
David N. Wilcock.
Comm of Surface Waters, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 75, pp 143-150, 1967. 8 p, 3 fig, 1 tab, 7 ref.

Descriptors: *Sediment transport, *Bed load, *River beds, *Channel morphology, *Particle size, Hydraulic gradient, Velocity, Discharge (Water), Turbulence, Hydraulics, Regime, Streamflow.
Identifiers: River bed morphology, River bed slopes.

Field tracer studies were undertaken to assess the part played by coarse bedload in determining the characteristics of bed slope at 21 sampling stations within the upper 20 sq mi of the upper Hodder catchment, Northeast Lancashire, England. Bedload sampling was based on linear transects of the stream, and description of the size characteristics upon the log normal distribution. Bed slope was surveyed at every reach by quickest level after the passage of a bankfull flood, and this slope was designated as the 'normal' slope of the reach under present discharge/sediment conditions. Statistical tests of slope/geometric mean particle size relationships were made. Lithology was seen to exert little effect on any relationship, and Hack's 1957 formula was confirmed as the one of most general applicability. Competence tests on 1,000 tracer pebbles allowed the calculation of critical shear stress for different size categories, from which it was possible to calculate for each of the 21 stations the bankfull competence, and residual bedload at each station. Bed slope was found to correlate logarithmically with the median of this residual bedload fraction, (r) exceeding 0.9. Implications of the work involve the concept of bed slope as either a relic feature, or as a function of bedload possibly supplied under present-day conditions but subject to diminuation only in situ. The attraction of such a relationship is that it introduces a dynamic aspect into the problem of bed slope, as opposed to the rather static explanations previously invoked. Some channel shape control is also implied. (Knapp-USGS)
W69-07545

DISCHARGE FREQUENCY COMPARED TO LONG-TERM SEDIMENT YIELDS,
Agricultural Research Service, Sidney, Mont. Northern Plains Soil and Water Research Center.
For primary bibliographic entry see Field 04D.
W69-07548

THE EFFECT OF MORPHOLOGICAL PROCESSES IN ALLUVIAL CHANNELS ON FLOW CONDITIONS,
Hydraulic Research Inst., Prague (Czechoslovakia).
Jaroslav Martinee.
Comm of Surface Waters, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 75, pp 243-249, 1967. 7 p, 5 fig, 1 tab, 4 ref.

Descriptors: *Bed load, *Sediment yield, *Channel Morphology, *Stage-discharge relations, Regime, Sediment load, Alluvial channels, Channel flow, Sands, Sediment transport, Roughness (Hydraulic), Discharge measurement.
Identifiers: Streambed morphology, Rating curves.

The continuously changing sandy bed in alluvial channels has a substantial influence on flow conditions. A series of experimental measurements was carried out in a representative river reach in order to study the effect of ripples and sand transport on flow resistance. The shape of river bed forms was measured in a broad range of discharges and the traveling velocity of sand ripples calculated to estimate the total volume of sediment transport. The correct stage-discharge relation gradually deviates from values which would be calculated for the basic river bed roughness. This difference can be as high as 50% of the expected value. The height of ripples increases with the growing discharge. In a representative river reach it corresponded roughly to one-fifth of the respective water depth and similar ratios have been observed at other sites. A substantial increase of flow resistance is caused by the effect of sand ripples and sand transport, reducing the channel capacity to one-half of the value predicted only by the grain size of the bed material. A considerable shifting of discharge rating curves must be expected, and is shown by comparison of measurements in the representative river reach over an 11 year period. (Knapp-USGS)
W69-07549

2K. Chemical Processes

ON THE OCCURRENCE OF NATURAL HYDROCARBONS IN WATERS (GERMAN),
Coblentz Federal Hydrologic Labs. (West Germany).
Hubert Hellman, and Franz-Josef Bruns.
Deut Gewasserkundliche Mitt, 13 Jahrgang, Heft 2 pp 54-60, Apr 1969. 7 p, 8 fig, 1 tab, 13 ref.

Descriptors: *Oily water, *Water chemistry, *Ponds, Analysis, Surface waters, Suspended load, Plankton, Sediments, Methane, Plants, Soils, Oil, water, River beds, Algae, River flow.
Identifiers: *Germany, Rhine River, Hydrocarbo occurrence in water.

The occurrence of hydrocarbons in the surfac waters and sediments of rivers and ponds was in vestigated on the basis of spectral and chemica analyses of water samples of the Rhine River a Koblenz, Germany, and several ponds. The stud shows that a considerable amount of organi matter is often present in the sediments and wate of rivers, lakes and ponds. (Gabriel-USGS)
W69-07369

PRINCIPLES AND APPLICATIONS I AQUATIC MICROBIOLOGY,
Rutgers - The State Univ., New Brunswick, N. Dept. of Environmental Sciences.

H. Heukelekian and Norman C. Dondero, (Ed tors). Proc Rudolfs Res Conf, Rutgers Univ, Ne Brunswick, NJ. John Wiley and Sons, Inc, Ne York, 1963. 452 p.

Descriptors: *Aquatic microbiology, *Co ferences, Actinomycetes, Aquatic bacteri Aquatic microorganisms, Coliforms, Euteric ba teria, Iron bacteria, Marine microorgamism Methane bacteria, Photosynthetic bacteri Photosynthesis, Sphaerotilus, Pesticid Phosphorus compounds, Lakes, Ponds, Self-puri cation, Rivers, Interfaces, Pigments, Fermentatio Methane, Infiltration, Sulfur compounds.
Identifiers: Alkanes, Hydrocarbons, Mangane bacteria, Leptothrix, Arthrobacter, Chemic transformation, Rumen bacteria, Rumen protozo Proteolysis, Research planning.

This volume comprises the proceedings of the thi Rudolfs Research Conference held in 1963 at Ru gers University. 'Aquatic microbiology' is us here in its broadest sense and embrac phenomena in lakes, reservoirs, streams, estuari oceans, or sewage treatment processes. Arrange of the conference attempted to cross disciplina lines because techniques and insights fr peripheral areas can contribute to knowledge aquatic microbiology. Editors state that differenc in the diverse environments considered are mer quantitative with respect to organic and inorgar nutrients. Their objective was to make meaningf the organisms and their activities in these enviro ments. The publication includes individual co tributions on the following topics, which will be a stracted separately: effect of hydrocarbon structu on bacterial alkane utilization; microbiology pesticides and related hydrocarbons; microb transformation of minerals; role of phosphorus microbial ecology; iron and manganese bacter Sphaerotilus-Leptothrix organisms; deteriorati of organic materials by marne organisms; lake a pond bacteria; river bacteriology and self-purifi tion; interfacial bacteriology; coliform physiolo actinomycetes; Arthrobacter; ecology a physiology of photosynthetic bacteria; protists, p ments, and photo-synthesis; methane fermentatio transformations in infiltration ponds; rumen ba teriology; physiology of rumen protozoa; microb transformation of organic sulfur; proteolytic orga isms; and trends and needs in research. See a W69-07424 thru W69-07435 (Eichhorn-Wisc)
W69-07423

OLOGY AND PHYSIOLOGY OF THE IOTOSYNTHETIC BACTERIA,
nnsylvania State Univ., University Park. Dept. of crobiology.
S. Lindstrom.
oc Rudolfs Res Conf, Rutgers Univ, New Brunick, NJ. Principles and Applications in Aquatic crobiology, Heukelekian, H and Dondero, Norn C (eds), John Wiley and Sons, New York, pp 0-297, 1964. 6 fig, 3 tab, 20 ref, disc.

scriptors: *Photosynthetic bacteria, hotosynthesis, *Ecology, *Aquatic microbiolo-, Molecular structure, Carbon, Sulfur comunds, Aerobic bacteria, Anaerobic bacteria, mestic wastes, Industrial wastes, Oxidation, etabolism, Ammonia, Nitrogen fixation, Amino ds, Phototropism, Pigments, Mud, Ponds, reams, Absorption, Chlorophyll, Wisconsin, nnsylvania.
entifiers: *Taxonomy, *Physiology, hotometabolism, Conversions, Heterotrophs, olecules, Assimilation, Pseudomonadales, hiorhodaceae, Thiorhodaceae, Chlorobacaceae, Rhodospirillum rubrum, Lake Mendota Vis), Chromatophores, Carotenoids, Fixation, tochromes, Quinones.

otosynthetic bacteria are classified according to gment, usual electron donor, respiratory etabolism, and growth factor requirements. Feaes in common are: polar flagella, possession of hydrative type of glucose splitting, and otosynthetic metabolism similar to photosynthe- of green plants. Morphologically and physiologily grouped with Pseudomonas, they occur in ds in freshwater and marine environments under ht and anaerobic conditions. Major importance their use in the study of photosynthesis rather an as metabolizers of problem molecules from mestic or industrial waste. Their photometabol- results in assimilation, especially of lowolecular-weight carbon- and sulfur-containing olecules. Bacteria cannot carry out rapid converns and would be overgrown by aggressive terotrophs. If attractive to some protozoan or ner grazing fauna, they might be significant in nitary microbiology. The nutrients they assimie form solely new cellular material. In light, they verse the effect of the majority of microorganns which specialize in decomposition and assimie carbohydrates completely. Significant is their echanism, localized in the cell membranes, for tting energy from light with the chlorophyll, rotenoids, cytochromes, quinones, as do the gher plants. They all metabolize gases, carbon, drogen, and nitrogen in the light, and some etabolize oxygen in the dark. For main entry see 69-07423. (Jones-Wisc)
69-07430

CTERIORATION OF ORGANIC MATERIALS MARINE ORGANISMS,
ll Telephone Labs., Inc., Murray Hill, N. J.
aldimero Coscarelli.
oc Rudolfs Res Conf, Rutgers Univ, New Brunick, NJ. Principles and Applications in Aquatic icrobiology, Heukelekian, H and Dondero, Norn C (eds), John Wiley and Sons, New York, pp 3-147, 1964. 11 fig, 15 tab, 16 ref, disc.

escriptors: *Marine microorganisms, *Aerobic, naerobic, *Bacteria, *Deterioration, *Organic atter, *Sea water, *Mollusks, *Crustaceans, astics, Elastomers, Resins, Rocks, Insulation, ams, Isopods, Carbon, Nitrogen, Phosphorus, epth, Temperature, Pressure, Conductors, astings, Rubber, Fibers (Plant), Sediments, Foul-g, Fungi, Carbohydrates, Sulfides.
entifiers: Bell System, Cables, Wood, Jute, mp, Malayan gum, Laminates, Borers, Shell, eredo, Bankia, Limnoria, Gutta percha, Gulf of orinth, Pholodidae, Gribble, New Zealand, olyhead, Dublin, Adriatic Sea, William F Clapp aboratories, Duxbury (Mass), Wrightsville Beach NC), Daytona Beach (Fla), Fibers (Synthetic), al products.

To determine resistance of synthetic materials in marine environments, marine borers were studied under natural exposure conditions and bacteria under laboratory conditions. In marine situations, over seventy materials (600 individual specimens) were exposed. Deterioration was confined primarily to attack by marine borers. Most plastic materials resisted borers and microorganisms, except the poly (vinyl chlorides) and polymides, half of which types were penetrated by pholads. Rubber samples showed evidences of borer penetrations and surface cracking. Polymide fibers apparently resist borers and microorganisms better than treated natural fibers. Polyethylene has shown negligible deterioration both in laboratory and ocean exposures. Castings resins resisted bacterial attack but were penetrated by pholads. Susceptibility of elastomers in laboratory studies indicates that bacteria may be implicated in the surface cracking phenomenon, appearing on ocean exposure specimens after seven years. Synthetic cellulosic fibers are degraded in ocean environment by borers and microorganisms, and preliminary laboratory studies indicate some susceptibility to bacteria. Although gross observations of poly (vinyl chlorides) subjected to ocean environments reveal no signs of microbial activity, laboratory studies provide ample evidence that these materials, depending upon formulation, can be utilized by bacteria under certain optimum conditions. For main entry see W69-07423. (Jones-Wisc)
W69-07433

IRON AND MANGANESE BACTERIA,
Illinois Univ., Urbana. dept. of Microbiology.
R. S. Wolfe.
Proc Rudolfs Res Conf, Rutgers Univ, New Brunswick, NJ. Principles and Applications in Aquatic Microbiology, Heukelekian, H and Dondero, Norman C (eds), John Wiley and Sons, New York, pp 82-97, 1964. 13 fig, 1 tab, 24 ref.

Descriptors: *Bacteria, *Iron, *Manganese, Oxidation, Water works, Electron microscopy, Springs, Seepage, Nutrient requirements, Pollutants, Iron oxides, Physiological ecology, Acidity, Acid mine water, Enzymes, Electrochemistry, Biochemistry, Metabolism, Estuarine environment.
Identifiers: Gallionella, Ferrous ions, Ferric hydroxide, Flagella, Micrographs, Leptothrix ochracea, Leptothrix major, Leptothrix discophora, Leptothrix trichogenes, Sphaerotilus natans form eutrophica, Chlamydothrix sideropus, Leptothrix sideropus, Clonothrix fusca, Thiobacillus ferrooxidans, Ferrobacillus ferrooxidans, Ferrobacillus sulfooxidans, Crenothrix polyspora, Taxonomy, Chlamydobacteria, Manganese oxide, Autothrophy, Morphology, Adenosine triphosphate.

Species of iron and manganese bacteria are separated taxonomically by biochemical behavior, especially ability to oxidize iron and manganese, and by cell depositions and structures. Iron bacteria are gradient organisms, establishing themselves at a propitious point between the source of ferrous ions and the air, and are found especially in estuarine environments, natural iron springs, seepages, and acid mine drainage. Studied with the electron microscope, the twisted stalks, composed of strands of ferric hydroxide, and flagella are found in Gallionella. The sheath-forming iron bacteria, like hollow iron pipes with ferric hydroxide, are controversial. The diversities of form may depend upon nutrients, thus sheaths may not be found in yeast extract-tryptone medium. Slime formation was observed in a medium containing 0.5 percent peptone. Some have empty sheaths and no cells; others, long filaments and large cells; or short brittle sheaths, mostly empty. Crenothrix polyspora has round non-motile, conidia-like cells derived from rod shaped cells. Two essentials for autotrophic existence to be explained are: adenosine triphosphate must be obtained for driving synthetic reactions, and the organism must obtain reducing potential for the reduction of carbon dioxide to the carbohydrate level. The enzymic steps in iron oxidation remain to be demonstrated. For main entry see W69-07423. (Jones-Wisc)
W69-07434

AMORPHOUS CLAY FRACTION OF SOILS AND ITS ADSORPTIVE PROPERTIES. A SELECTED BIBILOGRAPHY,
Wisconsin Univ., Madison. Dept. of Soil Science.
D. A. Graetz.
Scientific Information Program in Eutrophication, Wisconsin Univ, Madison, Document No 308064, 11 pp, Feb 1969. 140 ref.

Descriptors: *Adsorption, *Clays, *Soils, Chemical analysis, Insecticides, Sediments, Soil chemistry.
Identifiers: Chemical composition.

This bibliography contains 140 references relating to the noncrystalline clay fraction of soils and sediments, and should be of value to anyone working on their characterization. The difficulty in isolation of these materials has meant that they have been largely overlooked although, in many sediments, they may comprise a sizeable portion of the total. Also included are some references bearing on adsorptive properties of these amorphous minerals, particularly as regards insecticide adsorption. (Konrad-Wisc)
W69-07436

AN INVESTIGATION OF THE INTERRELATIONSHIP OF ORGANIC MATTER ,AND TRACE ELEMENTS IN FRESH WATER,
Rhode Island Univ., Kingston. Water Resources Center.
James T. Corless.
Completion Report OWRR Project A-013-RI, 1968. 25 p.

Descriptors: *Trace elements, *Organic matter, *Copper, *Water analysis, *Ponds, *Brackish water.
Identifiers: *Organo-metallic compounds, *Anoxic zone.

The distribution of copper in an unpolluted natural water system was investigated. Samples were taken from a fresh water pond and its downstream brackish water extension, containing an underlying saline, anoxic (H_2S detectable) basin. Neutron activation analysis was used to determine total copper, organic copper, and copper extractable with organic solvents. This was done for the particulate, colloidal and dissolved ranges of the water samples. Copper concentrations were variable in the pond and brackish river waters during the study period. A hypothesis was developed to relate some of the changes in the pond's copper concentrations to fluctuations in rainfall. Variations in copper distribution between the three different particle size ranges and their organic content were observed. Most of the copper detected in the anoxic zone appeared to be associated with particulate organic material that had precipitated out of the overlying waters. Organic solvents yielded evidence of three different organo-copper compounds existing in the three environments sampled. (Thompson-Rhode Island Univ0
W69-07470

DEVELOPMENT OF METHODS FOR CONTROLLING THE COPPER CONTENT IN WATER,
Rhode Island Univ., Kingston. Water Resources Center.
For primary bibliographic entry see Field 05F.
W69-07471

POND ECOLOGY AND WATERFOWL PRODUCTION IN RELATION TO OPTIMUM WATER RESOURCES UTILIZATION IN THE TURTLE MOUNTAINS OF NORTH DAKOTA,
North Dakota State Univ., Fargo. Dept. of Zoology.
For primary bibliographic entry see Field 06G.
W69-07475

BIOCHEMICAL RELATIONSHIPS AND INORGANIC NITROGEN EQUILIBRIUM IN SEMI-ENCLOSED BASINS,
Swedish Oceanographic Inst., Goteborg.

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R. Sen Gupta.
Tellus, Vol 21, No 2, pp 270-281, 1969. 12 p, 5 fig, 3 tab, 13 ref.

Descriptors: *Pollutants, *Biochemistry, *Nitrogen, *Lake basins, Oxidation, Lagoons, Anaerobic bacteria, Nitrates, Sulfates, Equilibrium, Hydrogen, Phosphates, Hydrologic data, Fjords, Statistical methods, Life cycles.
Identifiers: Semi-enclosed basin biochemistry.

A state of equilibrium of the inorganic nitrogen compounds in anoxic basins was investigated on the basis of concentration measurements of nitrate-, nitrite-, and ammonia-nitrogen using the pE parameter. The study shows that in narrow basins and under oxidation conditions the system nitrite-nitrate is found to approach certain equilibrium values. From the proximity of the calculated values to the equilibrium values the system nitrate-nitrite-ammonium appears to exist at least in partial equilibrium in marine environments independent of the general equilibrium condition controlled by the system hydrogen-hydrogen-ion-water. (Gabriel-USGS)
W69-07504

SOLUBILITY OF ALUMINUM IN THE PRESENCE OF HYDROXIDE, FLUORIDE, AND SULFATE,
Geological Survey, Washington, D. C.
C. E. Roberson, and J. D. Hem.
Geol Surv Water-Supply Pap 1827-C, 1969. 37 p, 18 fig, 5 tab, 19 ref.

Descriptors: *Water chemistry, *Aqueous solutions, *Solutes, *Solu bility, Aluminum, Fluorides, Sulfates, Ions, Temperature, Pressure, Free energy, Thermodynamics, Mineralogy.
Identifiers: Aluminum hydroxides.

The total concentration of aqueous dissolved species of aluminum that will be present in equilibrium with microcrystalline gibbsite at various levels of complexing ligand concentration are shown graphically. The graphs can be used to estimate aluminum solubility, at 25 deg C and 1 atmosphere total pressure, when the pH of the solution, its ionic strength, and the total sulfate and fluoride concentrations are known. The standard free energy of formation of cryolite calculated from solubility experiments is -745.4+ or minus 1.0 kcal per mole at 25 deg C. Diagrams are included showing the solubility of cryolite in terms of aluminum, fluoride, and sodium concentrations. The stability fields of cryolite and microcrystalline gibbsite and their solubilities also are shown on pH- (F) diagrams. (Knapp-USGS)
W69-07515

CHEMICAL EQUILIBRIUM BETWEEN GYPSUM AND BRACKISH AND SLIGHTLY SALINE WATERS AT LOW TEMPERATURE AND PRESSURES,
Bordeaux Univ. (France). Hydrogeological Centre.
J. A. Cherry.
Chem Geol, Vol 3, No 4, pp 239-247, Dec 1868. 9 p, 3 fig, 5 tab, 20 ref.

Descriptors: *Water chemistry, *Gypsym, *Equilibrium, Chemical potential, Sulfates, Ionization, Solubility, Aqueous solutions, Solutes, Saturation, SOLVATION.
Identifiers: Ionic activity coefficients.

The solubility product of gypsum was calculated from free energy of reaction and used to evaluate the procedure of Garrels and Thompson for calculating ionic species in natural waters of brackish to slightly saline composition. It was found that cumulative errors in the method are appreciable. With routine water analyses and our present knowledge of dissociation constants and activity coefficients, we must allow a broad interval of possible saturation values. (Knapp-USGS)
W69-07518

PREVENTION OF ADSORPTION OF TRACE AMOUNTS OF GOLD BY CONTAINERS,
Geological Survey, Denver, Colo.
T. T. Chao, E. A. Jenne, and L. M. Heppting.
Geol Surv Res 1968, Prof Pap 600-D, pp D16-D19, 1968. 4 p, 4 fig, 4 ref.

Descriptors: *Sampling, *Water analysis, *Adsorption, *Trace elements, *Gold, Aqueous solutions, Treatment.
Identifiers: Sample preservation.

Loss of significant parts of trace amounts of gold by adsorption on container walls, during sample transport and storage, poses a major problem in quantitative determinations of gold in natural water. Experiments using gold-198 as a tracer indicate that gold may be kept in solution for 21 days by (1) acidification of a test solution to pH 1 with hydrochloric acid to and addition of between 5 to 50 mg/1 of bromine, (2) acidification with hydrochloric acid to 1N without bromine, and (3) acidification with nitric acid to 2N or 3N. After 21 days, radioactive decay reduces gamma radiation of gold-198 beyond the limits of accuracy of available equipment and no information was obtained. Addition of 50 mg/1 of bromine to a nonacidified test solution of pH 6 is almost as effective. In contrast to nonacidification, moderate acidification of the test solution to pH 2 or 3 with hydrochloric and acetic acids, as well as acidification to pH 1 with nitric acid, enhances gold adsorption. The pH 1 hydrochloric acid and 50 mg/1 bromine combination is as effective in desorbing gold from container walls as it is in preventing gold adsorption. (Knapp-USGS)
W69-07531

ADSORPTION OF TRACES OF SILVER ON SAMPLE CONTAINERS,
Geological Survey, Denver, Colo.
T. T. Chao, E. A. Jenne, and L. M. Heppting.
Geol Surv Res 1968, Prof Pap 600-D, pp D13-D15, 1968. 3 p, 2 fig, 12 ref.

Descriptors: *Sampling, *Water chemistry, *Adsorption, *Trace elements, Water analysis, Aqueous solutions.
Identifiers: Sample preservation, Silver.

Special care is required to prevent container adsorption of significant parts of the trace amount of silver present in most natural waters. The use of strong acids appears to be the most effective means of retaining the silver in solution. Lowering the pH of the water samples to 1 with either hydrochloric or nitric acid reduced adsorption onto polyethylene containers to approximately 1% of the silver present. Silver adsorption after 30 days of contact time amounted to 4 and 10% of the silver present at pH 2 when adjusted with hydrochloric acid and nitric acid, respectively. Adjustment of the pH to 1 with either hydrochloric or nitric acid was effective in desorbing silver from polyethylene containers in the course of several days. (Knapp-USGS)
W69-07532

2L. Estuaries

TIDAL WAVE CALCULATIONS FOR VARIOUS RIVER REGULATION STAGES DEMONSTRATED BY EXAMPLE OF THE LOWER WESER AND THE LOWER HUNTE RIVERS (German),
Paul Strohmer.
Deut Gewasserkundliche Mitt, 13 Jahrgang, Heft 2, pp 48-54, Apr 1969. 7 p, 8 fig, 1 tab, 15 ref.

Descriptors: *Rivers, *Tidal waters, *Mathematical studies, Flow resistance, Sun, Moon, Dynamics, Topography, Surveys, River beds, Discharge coefficients, Velocity, Estuary, Water level fluctuations.

Tide-wave phenomena were investigated analytically and experimentally using the hydrologic and topographical data recorded along the lower reaches of the Weser and Hunte rivers of Western Germany. The study shows that reliable calculation of tide-wave parameters requires a sufficiently accurate estimate of flow resistance phenomenon. This accurate estimate, however, is based on a careful analysis of known regulation stages. (Gabriel-USGS)
W69-07368

LANDWARD TRANSPORT OF BOTTOM SEDIMENTS IN ESTUARIES OF THE ATLANTIC COASTAL PLAIN,
Geological Survey, Woods Hole, Mass.
Robert H. Meade.
J Sediment Petrol, Vol 39, No 1, pp 222-234, Mar 1969. 13 p, 9 fig, 1 tab, 65 ref.

Descriptors: *Sedimentation, *Estuaries, *Atlantic Coastal Plain, *Sediment transport, Currents (Water), Tidal effects, Tides, Bed load, Sands, Aggradation, Movement, Provenance, Sediment distribution, Aquatic drift, Deposition (Sediments).
Identifiers: Tidal currents.

The estuaries of the Atlantic Coastal Plain are being filled with sediment. River-borne sediment is partially trapped in the estuaries by the predominantly landward flow of estuarine bottom waters. The main evidence of this is measurements of the sediment flux (suspended-sediment concentration and water velocity measured at intervals of depth and through tidal cycles) that show sediment being moved progressively landward along the bottom. Comparisons of the loci of sediment deposition and the patterns of water circulation show that sediment accumulates in estuaries near the upstream limit of landward bottom flow. The movement of sands into the mouths of the larger estuaries from the continental shelf and nearby beaches is also suggested by several other lines of evidence. Bottom waters of the continental shelf move progressively into the mouths of estuaries, and they presumably carry bottom sediments with them. Beach sands move toward and into the mouths of some estuaries at rates of several hundred thousand cubic meters per year. Distinctive mineral components in the lower reaches of estuaries suggest that the bottom sediments were derived from offshore. The rates of filling of the estuaries are different in the northern and southern parts of the Coastal Plain. The large northern rivers carry disproportionately small loads of sediment that have not yet filled the deep valleys which were cut during the ice ages. The southern rivers carry large sediment loads relative to the sizes of their valleys and consequently their estuaries are mostly filled with sediment.
W69-07380

ORGANIC PRODUCTION IN A TROPICAL ESTUARY,
National Inst. of Oceanography, Cochin (India). Biological Oceanographic Div.
For primary bibliographic entry see Field 05B.
W69-07388

NEW DEVELOPMENTS IN THE FIELD OF TIDAL HYDRAULICS,
Army Coastal Engineering Research Center, Washington, D. C.
Joseph M. Caldwell.
ASCE Proc, J Hydraul Div, Vol 95, No HYI, Paper 6339, pp 1-8, Jan 1969. 8 p, 14 ref.

Descriptors: *Estuaries, *Tides, *Currents (Water), *Reviews, Hydraulics, Saline water intrusion, Tidal effects, Water level fluctuations, Channel flow, Bibliographies.
Identifiers: Tidal hydraulics, Tidal currents.

The recent advances in tidal hydraulics and the methods of solving tidal hydraulics problems are reviewed. The problems of inlets, canals, and estuaries (including salt water intrusion) are considered and the bibliography gives a selection of the most recent literature on these subjects. The role of the hydraulic model and the computer is described

e stability of inlets is related to tidal range and et cross section. No attempt to develop the ocedures for solving tidal hydraulics problems is de; the recent, meaningful advances in this area engineering are discussed and the literature ere more detailed descriptions can be found is iewed.
69-07396

DAL STREAM ACTION AND SEA LEVEL IANGE AS ONE CAUSE OF VALLEY MEAN-RS AND UNDERFIT STREAMS,
wcastle Univ. (Australia). Dept. of Geography.
F. Geyl.
stralian Geogr Stud, Vol 6, pp 24-42, 1968. 19 7 fig, 1 tab, 32 ref.

scriptors: *Streams, *Valleys, *River basins, leanders, Stream erosion, Streambeds, Stream-w, Tides, Sea level, Estuaries.
ntifiers: *Underfit streams, Sea level changes.

a level change is proposed as a cause of underfit eams for coastal plain streams as well as for ny cases of underfitness that cannot be ex-ined by climatic change. Lowering of relative level has caused the replacement of large-charge tidal streams by small-discharge ordinary ers, the one-time tidal channels thus becoming leys, or valley bottoms, now modified in varying gree by sub-aerial processes since emergence. me cartographic and morphometric evidence in pport of this tidal hypothesis is presented. Un-fitness would appear to occur in equatorial re-ns as well as in the climate zones to which Dury uld limit the phenomenon. Topographic maps of nganyika, Ghana, Nigeria and elsewhere give the pressinon that valley meanders are to be found re. This is to be expected on the tidal hypothes-as sea level changes would have affected all sts. Much more research, and field work in par-ular, will have to be done before this tidal pothesis can be firmly established. That climate ange has occurred and has affected river charges and fluvial landforms is not denied. But t sea level changes have occurred is equally cer-n. A general theory of underfit streams based ly on climate change does not seem satisfactory. napp-USGS)
69-07417

DAL FLAT SEDIMENTATION ON THE OLORADO RIVER DELTA, ORTHWESTERN GULF OF CALIFORNIA,
mboldt State Coll., Arcata, Calif.
r primary bibliographic entry see Field 02J.
69-07422

ATER RESOURCES DEVELOPMENT OF ULLICA RIVER BASIN, NEW JERSEY,
tgers - The State Univ., New Brunswick, N. J.
ater Resources Research Inst.
r primary bibliographic entry see Field 06B.
69-07456

YDROLOGY OF NEOGENE DEPOSITS IN IE NORTHERN GULF OF MEXICO BASIN,
uisiana State Univ., Baton Rouge.
ul H. Jones.
lletin GT-2, Apr 1969, La Water Resources search Inst. 105 pp, 36 fig, 4 tab, 93 ref, 4 app.

scriptors: Hydrogeology, *Aquifers, *Pore pres-re, Permeability, Clay minerals, *Diagenesis, mbrane processes, *Osmosis, Ion exchange, hermal water, Connate water, *Salinity, Sedi-ntation, Dehydration, Water of crystallization, lf of Mexico, Gulf Coastal Plain, Heat flow.
ntifiers: Neogene deposits, Geothermal adient.

e Neogene deltaic and neritic marine deposits in northern Gulf of Mexico Basin form regional uifer systems in which pore pressures, salinities, d temperatures do not compare with those in older sedimentary basins. Rapidly buried sand and clay sequences, sealed off by growth faults, remain undercompacted and contain abnormally high fluid pressures (up to 0.96 times the overburden pressure). Such high pressures force saline formation water toward normally-pressured aquifers. The intervening clay beds act like membrane filters to freshen the water, which subsequently dilutes the receiving aquifers. High pressures and trapped radiogenic heat cause diagenesis of montmorillonite to illite. The released fresh water of crystallization either remains in the transformed clay under high pressure, because the adjacent sand beds are already geopressured, or flows to and dilutes normally-pressured aquifers. Osmotic pressures, which are generated by the membrane-like clays and which may be responsible for halting or even reversing these flows, are considered the dominant factor in the preservation of abnormal high pressures. Salinities vary from a few hundred to 300,000 mg/l at any depth below 6,000 feet. Generally decreasing salinities are evident below 12,000 feet. (Hill-Louisiana State Univ)
W69-07467

BIOCHEMICAL RELATIONSHIPS AND INORGANIC NITROGEN EQUILIBRIUM IN SEMI-ENCLOSED BASINS,
Swedish Oceanographic Inst., Goteborg.
For primary bibliographic entry see Field 02K.
W69-07504

FACTORS INITIATING PHYTOPLANKTON BLOOMS AND RESULTING EFFECTS ON DISSOLVED OXYGEN IN DUWAMISH RIVER ESTUARY, SEATTLE, WASHINGTON,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 05C.
W69-07507

ESTUARINE WATER QUALITY MANAGEMENT,
California State Water Resources Control Board, Sacramento. San Francisco Bay-Delta Program.
For primary bibliographic entry see Field 05G.
W69-07522

MIXING OF COLUMBIA RIVER AND OCEAN WATERS IN SUMMER,
Washington Univ., Seattle. Dept. of Oceanography; and Smithsonian Institution, Washington, D. C.
T. John Conomos, and M. Grant Gross.
ASCE Proc, J Sanit Eng Div, Vol 94, No SA5, Pap 6187, pp 979-994, Oct 1968. 16 p, 10 fig, 22 ref.

Descriptors: *Estuaries, *Columbia River, *Mixing, *Sea water, *Streamflow, *Pacific Ocean, Nutrients, Dissolved solids, Salinity, Currents (Water), Water quality, Circulation, Eddies, Salinc water-freshwater interfaces.
Identifiers: Upwelling (Water).

Mixing between Columbia River water and the adjacent ocean water is a 2-stage process controlled primarily by high river discharge. The first-stage mixing, of fresh water of the river and upwelled deeper ocean water, occurs within the estuary and yields low-salinity water. The second-stage mixing, of seaward-flowing low-saline water and deeper ocean water, occurs primarily in the transition area within 20 km of the river, and adds additional nitrate and phosphate. During summer the river is the dominant contributor of dissolved silicate. Because of summer photosynthetic depletion, the river contributes virtually no nitrate; the deep ocean water contributes most of the phosphate and nearly all the nitrate. In the oceanic area, the low-salinity surface water lies above the surface ocean water which inhibits further upward nutrient transfer by mixing. Nitrate is depleted within 30 km of the river. The lack of nitrate therefore limits photosynthetic activity in the surface ocean layers. (Knapp-USGS)
W69-07523

DYNAMIC DIVERSION: INFLUENCE OF LONGSHORE CURRENT-TIDAL FLOW INTERACTION ON CHENIER AND BARRIER ISLAND PLAINS,
California Univ., Davis. Dept. of Geology; and California Univ., Bodega Bay, Calif. Bodega Marine Lab.
Thomas W. Todd.
J. Sediment Petrol, Vol 38, No 3, pp 734-746, Sept 1968. 13 p, 2 fig, 27 ref.

Descriptors: *Sedimentation, *Beaches, *Deltas, *Tidal effects, *Littoral drift, Mississippi River, Gulf of Mexico, Ocean waves, Tides, Currents (Water), Intertidal areas, Bed load, Suspended load, Hydraulics.
Identifiers: *Chenier plains, Mississippi delta, Barrier islands.

Chenier and barrier island plains are characteristic products of post-Pleistocene sedimentation along the northern and western coasts of the Gulf of Mexico, but similar features may be recognized throughout the world. These plains have been formed by net progradational displacement of the sea throughout the latest 3,000 to 5,000 yr period of sea level stability. They consist of low, narrow, well-sorted shell and sand ridges that are elongate parallel with the former shoreline, and which are separated by tidal mud flats or zones of poorly sorted, fine sand. A correlation has been established in the vicinity of the Mississippi River delta, by means of radiocarbon dating, between low rate of fine sediment discharge into westward moving longshore currents, stability or minor recession of the downdrift shoreline, and slow accretion of well-sorted chenier beach ridge sand. High rate of sediment discharge into nearshore currents, however, coincides with rapid progradation of sandy, silty mudflat deposits along the downdrift shoreline. It is suggested that the presence of a high content of fine sediment in longshore currents changes their fluid dynamic characteristics in such a way as to enhance traction transport, inhibit separation of differing grain size modes, and thus promote deposition of unsorted detritus. Light sediment loads halt rapid progradation and induce reworking of previously accumulated sediment. Thus no change in general wave regime is required to account for alternation of chenier sand accumulation with interchenier mudflat deposition. (Knapp-USGS)
W69-07525

SEDIMENTARY PROCESSES OPERATIVE ALONG THE WESTERN LOUISIANA SHORELINE,
Continental Oil Co., Ponca City, Okla.
Arthur O. Beall, Jr.
J. Sediment Petrol, Vol 38, No 3, pp 869-877, Sept 1968. 9 p, 10 fig, 12 ref.

Descriptors: *Sedimentation, *Gulf of Mexico, *Beaches, *Louisiana, Tidal effects, Currents (Water), Littoral drift, Mississippi River, Ocean waves, Bed load, Suspended load, Hydraulics, Provenance.
Identifiers: Tidal currents.

Investigation of modern facies relationships along the southwestern Louisiana shoreline demonstrates the complex interaction of sediment supply and energy of coastal processes. Shallow water 'wave energy' and proximity to suspended mud supply are qualitatively shown to be dominant variables. Facies tracts show variation through a broad spectrum of geometries and sediment types. Mudflats, both intertidal and subaqueous, show highest rates of progradation, as compared to 'normal' sand-rich beaches with low rates of progradation. An intermediate type of strandline, represented by a thin sand beach resting on eroded mudflat and marsh sediment, is shown to prograde at rates intermediate between those of mudflats and normal beaches, even though geometrical relationships would suggest retrogradation. Consideration of the interaction of various partially dependent sedimentary processes outlined in this paper can be used to characterize rates of progradation as well as to predict sediment type and geometry. (Knapp-USGS)

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W69-07526

SUBMERGENCE ALONG THE ATLANTIC COAST OF GEORGIA,
Geological Survey, Richmond, Va.
Robert L. Wait.
Geol Surv Res 1968, Prof Pap 600-D, pp D38-D41, 1968. 4 p, 3 fig, 1 tab, 5 ref.

Descriptors: *Submergence, *Atlantic coastal plain, *Georgia, Subsidence, Estuaries, Radioactive dating, Carbon radioisotopes.
Identifiers: Glynn County (Ga), Brunswick River, Turtle River.

Cypress stumps recovered from river terrace material near Brunswick, Ga., may indicate submergence of the Atlantic coastal area during Holocene geologic time. The older material, found at a depth of from 9 to 17 ft below mean sea level, was dated by carbon-14 at 3, 670z or minus 300 years (B. P., 1950); the younger, found 1 ft above mean sea level and buried in 3 ft of marsh silt and clay, was dated at 2,780 and or minus 250 years B.P. Presence of the cypress stumps may indicate that fresh water once discharged from the Turtle River, now a drowned estuary. (Knapp-USGS)
W69-07533

THE PATTERN OF SEDIMENT MOVEMENT IN THE RIVER TYNE,
Department of Water Resources (England). Devon River Authority.
David G. Hall.
Comm of Surface Waters, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 75, pp 117-142, 1967. 26 p, 16 fig, 2 plate.

Descriptors: *Sediment transport, *Sedimentation, *Estuaries, Tides, Currents (Water), Sediment load, Sediment yield, Sediment discharge, Streamflow.
Identifiers: River Tyne (England).

The movement of sediments in the River Tyne and the Tyne estuary, northeast England, was studied in conjunction with a survey of the tidal hydraulics of the estuary. The mean annual discharge of the river is 1,452 cfs. Suspended load was estimated to be 132,000 tons per yr and bed load, 20,000 tons per yr. The amount entering from the sea is estimated from dredging records to be 120,000 tons per yr. Currents and sites of deposition are shown by maps and sections. (Knapp-USGS)
W69-07544

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

SCALE REDUCTION IN DESALINATION BY CALCIUM SULFATE SOLUBILITY INVERSION,
Rhode Island Univ., Kingston. Water Resources Center.
A. Ralph Thompson.
Completion Report OWRR Project A-012-RI, 1968. 16 p.

Descriptors: *Desalination, *Scale prevention, *Evaporation, *Additives, *Solubility, *Calcium Sulfate, *Heat transfer.
Identifiers: *Acrylic acid-amide copolymers, *Polyhall 295, *Sodium acrylate, *Cyanamer P35, *Polyacrylamides.

The purpose of this research was to find a method for reducing or eliminating calcium sulfate scale in saline water conversion processes by employing distillation or evaporation. The principle of the proposed method depends on the use of the additives to sea water which would give calcium sulfate a normal rather than inverted solubility behavior so it would not tend to deposit on heat transfer surfaces. After determining extensive data on almost fifty compounds, only three were found which, in relatively low concentrations, had the characteristics of holding the transient solubility of calcium sulfate in sea water practically invariant with temperatures up to about 255 deg. F. These compounds were (1) sodium acrylate (2) an anionic polyacrylamide and (3) an acrylic acid-amide copolymer. Tests run in an experimental evaporator using 10 - 20 p.p.m. of these promising additives showed remarkable reduction in scale formation on heat transfer surfaces. Preliminary economic evaluation indicated that the cost of additives may be reduced to one or two cents per 1000 gallons of fresh water produced.
W69-07469

DISPOSAL OF THE EFFLUENTS FROM DESALINATION PLANTS: THE EFFECTS OF COPPER CONTENT, HEAT AND SALINITY,
Dow Chemical Co., Freeport, Tex.
For primary bibliographic entry see Field 05C.
W69-07476

DISPOSAL OF THE EFFLUENTS FROM DESALINATION PLANTS INTO ESTUARINE WATERS,
Dow Chemical Co., Freeport, Tex.
For primary bibliographic entry see Field 05C.
W69-07477

SALINE WATER CONVERSION REPORT FOR 1968,
Office of Saline Water, Washington, D. C.
W. S. Gilliam.
Office Saline Water 1968 Rep, 1969. 489 p, 404 fig, 97 tab, 314 ref, 6 append.

Descriptors: *Desalination, *Research and development, Membrane processes, Desalination processes, Water purification, Aqueous solutions, Thermodynamics, Byproducts, Corrosion, Electrochemistry, Potable water, Saline water, Water chemistry, Distillation.
Identifiers: Office of Saline Water.

Desalination research, while maintaining a program of basic studies relevant to desalting, continues to emphasize applied research and the development of desalting technology. During 1968, the major portion of the research effort was concentrated in the fields of membrane technology, materials, design, and configuration studies of prototypes involving tubes, spirals, and composites for membrane processes and basic and exploratory research. It is believed the need for increased emphasis on these activities, plus a much greater effort in the fields of pretreatment of feed water, contaminated water, biomembranes, mineral recovery, new processes, and others, will be essential in the next few years. Research continues to emphasize the development of less costly materials having a potential for reduction of plants costs. The principal objective of the program is the development of the lowest cost desalination processes possible for use under a variety of conditions. Research progress during calendar 1968 is summarized in the reports of the five operating research divisions: Polymer and Biophysics, Applied Science, Materials, Chemical Physics, and Chemistry. (Knapp-USGS)
W69-07511

TRANSPORTATION OF DEMINERALIZED WATER,
San Diego Dept. of Utilities, Calif.
Roy E. Dodson.
ASCE Proc, J Sanit Eng Div, Vol 94, No PL1, Pap 6191, pp 127-135, Oct 1968. 9 p, 1 tab, 12 ref.

Descriptors: *Demineralization, *Pipelines, *Corrosion, *Corrosion control, *California, Water distribution (Applied), Transportation, Metal pipes, Concrete pipes, Steel pipes, Tiles, Distribution systems, Water treatment.
Identifiers: *Demineralized water.

The delivery of demineralized water through exi
ing distribution systems must be preceded by car
ful studies, and proper treatment or blendi
methods must be provided to avoid poor wat
quality and rapid corrosion. Experiences at S
Diego in 1962-1964 indicate that distilled seawat
can be successfully carried in an old tuberculat
cast iron main grid after treatment with limesto
and blending with Colorado River wat
Limestone treatment alone is inadequate to prote
new asbestos cement pipe from attack. A ne
facility placed in service in 1967 delivers distill
seawater to another section of San Diego aft
blending with highly mineralized well water. Prov
sion has been made to study the effects of pure a
blended waters on various pipe materials. The i
portance of temperature limits for consum
satisfaction is described. The very citations fou
on the subject in the literature are included. (
napp-USGS)
W69-07524

ON THE OPTIMAL DESIGN OF DESALIN
TION PLANTS,
Kansas State Univ., Manhattan.
L. T. Fan, L. E. Erickson, C. Y. Cheng, and C. L.
Hwang.
Proc, Nat Symp Anal Water-Resource Syst, pp 3
63, Denver, July 1968. 27 p, 13 fig, 6 tab, 28 ref.

Descriptors: *Desalination plants, *Optimizatio
*Design, Flash distillation, Reverse osmosis, Wat
supply, Water treatment, Mathematical mode
Economic justification, Operating costs, Constru
tion costs, Simulation analysis.
Identifiers: Multieffect multistage flash distillatio
Search techniques.

The optimal design of desalination plants w
described as one aspect in the optimization
water resource systems. Two investigations invo
ing the optimization of a multieffect, multista
flash distillation process and a reverse osmo
process were summarized to illustrate systems an
ysis procedures and to illustrate the results o
tained from that type of investigation. In order
optimize the process design, a mathematical mod
related the design variables to the behavior of t
physical system, an economic model related t
design variables to capital and operating costs,
objective function (minimization of water produ
tion cost) and an optimization procedure wa
used. It was demonstrated that a combined o
timization technique based on a discrete analog
the maximum principle and search techniques su
as the parametric search and gradient techniqu
were quite efficient for the study of a multista
multidecision process. Some composite desalin
tion systems which were currently being
vestigated were introduced. For main entry s
W69-07562. (Gysi-Cornell)
W69-07563

3B. Water Yield Improvement

THE ASPHALT MOISTURE BARRIER FO
FARMING DROUGHTY SOILS,
International Harvester Co., Chicago, Ill. Produ
Planning Research; and American Oil Co., Wh
ing, Ind. Research and Development Dept.
R. E. Baumheckel, L. C. Brunstrum, J. B. Corns,
and T. L. Speer.
International Conference on Arid Lands in
Changing World, Arizona University, Tucson, Ju
3-13, 1969. 22 p, 6 tab, 10 fig, 8 ref.

Descriptors: *Soil treatment, *Water yield i
provement, *Arid lands, Deserts, Subsurfa
drainage, Permeability, Infiltration, Soil wat
Water conservation, Oil industry, Retardance, R
tention, Water utilization efficiency, Water pro
ing, Crop production, Crop response, Economi
Irrigation efficiency, Cost-benefit analysis, Aspha
Barriers, Soil moisture, Equipment.

e evolution of equipment development is ex-
ined, as is moisture retention properties, in-
ases in crop yields and economics of asphalt
isture barriers (AMB). The AMB machine
unted on a TD-25C gear driven crawler tractor
h a crew of two men is expected to lay from 1.0
1.5 acres of barrier per hr. at a depth of 2 ft.
duction of infiltration rate from 3 in. to about
in per hr. has been demonstrated. In Arizona ir-
ation usage was reduced to 47% of the control
t. The barrier without irrigation produced better
p yields than the irrigated control, and
quently better than irrigated barrier plots. The
ncipal cost is asphalt. Under present U.S.
nomic conditions a barrier can be installed for
0 to $300 per acre. The payout for the farmer
be from one to four years, and the barrier could
fifteen years. (Sherbrooke-Ariz)
9-07344

CAL WATERS OF THE ARID ZONE OF THE SR AND THEIR UTILIZATION,
ademiya Nauk SSSR, Moscow. Institut
ografii.
N. Kunin.
ernational Conference on Arid Lands in a
anging World, Arizona University, Tucson, June
3, 1969. 12 p, 6 ref.

scriptors: *Arid lands, *Saline water, *Water
ization, Deserts, Basins, Runoff, Standing
ers, Surface-groundwater relationships,
salination, Stockwater, Water consumption.
ntifiers: *U.S.S.R.

e area of the U.S.S.R's arid zone is about 3
ln. sq. km. Development depends on the use of
sit streamflow, underground water, and
cipitation. Traditional methods (i.e. wells) of
derground water use are very limited by high
nity. Surface runoff collection by native popula-
ns in floating freshwater lenses on saline ground-
er and modern efforts are considered. Each 100
km of pasture with 1,500 sheep needs only 0.04
km. of artificial drainage area with an annual ru-
f of 75 mm. Stock can consume mineralized
er, and procurement of freshwater for man is no
blem. The upper salinity limit for stock water is
000-15,000 p.p.m. and for irrigated cultivation
stock fodder is 10,000-15,000 p.p.m. Large
shwater lenses have been discovered and
nomic methods of underground water intake
e introduced, preventing salt water intrusion. A
thod of natural freezing desalination is men-
ied. Acceptability of total river runoff utiliza-
n, and its resulting consequences in the large
er drainage basins that form the Caspian Sea,
Aral Sea and other isolated waters, is presently
ng debated in the U.S.S.R. (Sherbrooke-Ariz)
9-07352

ATER USE BY SALTCEDAR VARIES WITH NY FACTORS,
ological Survey, Lubbock, Tex.; and Texas
chnological Coll., Lubbock.
E. A. Van Hylckama.
ernational Conference on Arid Lands in a
anging World, Arizona University, Tucson, June
3, 1969. 20 p, 4 tab, 7 fig, 11 ref.

scriptors: *Tamarisk, *Evapotranspiration con-
, Evapotranspiration, Arid lands, Consumptive
, Phreatophytes, Riparian plants, Riparian water
, Phreatophyte control, Moisture availability,
ter table, Bank storage, Growth rates, Salt
erance, Saline water, Soil-water-plant relation-
ps, Soil moisture.
ntifiers: *Evapotranspirometers.

ree years of observations on water use by salt-
dar, conducted in a battery of evapotranspirome-
(tanks), resulted in reliable answers to
estions of phreatophyte waste. The quantity of
ter evaporation or transpiration depends on the
pth of groundwater. It also depends on the salini-
f the soil moisture. In soils which have an elec-
al conductivity of saturation extract of 30 mil-
limhos, water use is half that of those having 10 mil-
limhos. With low salinity of soil moisture salt cedar
sprouts grow faster than under high salinity condi-
tions. Growth characteristics between controlled
and thinned-out stands are not significant. Thin-
ning and cutting are shown to be ineffective
methods of saving water. Under favorable condi-
tions shoots can increase by as much as 50 mm per
day. Methods of vegetation survey and extrapola-
tion of water use as measured in evapotranspirome-
ters to a 100% density can seriously overestimate
water use as a 75% cover density may use as much
water as 100%. Programs of saltcedar eradication
along dry river beds with water table at 4 meters for
the purpose of saving water are seriously
questioned as to effectiveness. (Sherbrooke-Ariz)
W69-07359

A RECONNAISSANCE OF THE GROUND-WATER GEOLOGY OF MONTVILLE TOWNSHIP, MEDINA COUNTY, OHIO,
Kent State Univ., Ohio. Dept. of Geology.
For primary bibliographic entry see Field 04B.
W69-07492

WATER RESOURCES OF THE BIG OTTER CREEK DRAINAGE BASIN,
Water Resources Commission (Ontario).
U. Sibul.
Ontario Water Resources Comm, Water Resources
Rep 1, 1969. 91 p.

Descriptors: *Water resources, *Groundwater,
*Surface waters, Water wells, Water quality,
Aquifers, Glacial drift, Water yield, Water levels,
Discharge (Water).
Identifiers: *Ontario, Big Otter Creek Basin.

Field investigations were made of surficial geology,
surface-water flows, and farm water use in the Big
Otter Creek Basin, Ontario. Observation wells were
installed and water samples were collected for
chemical analysis. A simplified hydrologic budget
is presented. The only area in the basin where there
is difficulty in obtaining sufficient ground-water
supplies of acceptable quality is in the southern
portion. Ground-water supplies in the rest of the
basin are derived from sand and gravel aquifers and
water-bearing zones in the upper portions of the
bedrock. Most of these waters are of good quality
for domestic, stock and irrigation purposes. Sur-
face-water supplies are utilized mostly for irriga-
tion, and at most locations are adequate in quantity
and quality. Stream runoff, composed to a large
degree of ground-water discharge, is the main
source of surface-water supply. The withdrawal of
water during short periods of irrigation in July and
August has a marked effect on the streamflow of
Big Otter Creek. In the 1964-65 water year, total
precipitation for the basin was 30.81 inches, or
6.85 inches below the normal. Stream runoff was
15.10 inches, and evapotranspiration was 15.71
inches. The water resources were found to be
generally adequate for the present uses in the basin;
however, local shortages and quality problems exist
and require special development and management
practices. (Knapp-USGS)
W69-07508

REGIONAL HYDROGEOLOGY OF THE NAVAJO AND HOPI INDIAN RESERVATIONS, ARIZONA, NEW MEXICO, AND UTAH,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02F.
W69-07512

WATER RESOURCES OF THE BUFFALO RIVER WATERSHED, WEST-CENTRAL MINNESOTA,
Geological Survey, Washington, D. C.
R. W. Maclay, L. E. Bidwell, and T. C. Winter.
Geol Surv Hydrol Invest Atlas HA-307, 3 sheets,
1969. 31 fig, 14 maps, 2 tables.

Descriptors: *Water resources, *Surface waters,
*Groundwater, *Minnesota, Streamflow, Runoff,
Water levels, Water wells, Aquifers, Glacial drift,
Sands, Gravels, Recreation, Irrigation water, Water
quality, Water utilization.
Identifiers: Buffalo River Watershed (Minn).

The water resources of the Buffalo River
watershed, west-central Minnesota are described in
a 3-sheet hydrological atlas consisting of maps,
graphs, charts, and text. The annual runoff ranges
from 0.7 to over 3.2 inches and averages 1.4
inches. All but 1 of the communities of the area use
groundwater. Irrigation water is obtained from
streamflow, and more could be developed with
reservoirs. Flooding is caused mainly by snowmelt
and spring rains. Most groundwater is obtained
from glacial drift aquifers; supplies are adequate
for domestic and stock use everywhere, and large
supplies may be obtained from sand and gravel len-
ses. Water quality is suitable for most uses. Runoff
data are summarized by hydrographs. Surficial
geology, water use, streamflow, aquifers, water
yields, water levels, water quality, and recreational
use are shown by maps. (Knapp-USGS)
W69-07513

WATER RESOURCES OF THE OTTER TAIL RIVER WATERSHED WEST-CENTRAL MINNESOTA,
Geological Survey, Washington, D. C.
T. C. Winter, L. E. Bidwell, and R. W. Maclay.
Geol Surv Hydrol Invest Atlas, HA - 307, 4 sheets,
1969. 31 fig, 2 tab, 22 maps.

Descriptors: *Water resources, *Surface waters,
*Groundwater, *Minnesota, Streamflow, Runoff,
Water levels, Water wells, Aquifers, Glacial drift,
Sands, Gravels, Recreation, Irrigation water, Water
quality, Water utilization.
Identifiers: Otter Tail River Watershed (Minn).

The water resources of the Otter Tail River
watershed, west-central Minnesota are described in
a 4-sheet hydrological atlas consisting of maps,
graphs, charts, and text. Large amounts of ground-
water are available from sand and gravel deposits
along the Otter Tail River. Yields of over 1,000
gpm are available. Most of the water has low sodi-
um hazard and medium salinity hazard, and is suita-
ble for irrigation on most soils. Average runoff is
1.9 in per year. Flooding is minor and usually
caused by ice jams. Water based recreational op-
portunities are very good, particularly for canoe-
ing. Runoff data are summarized by hydrographs.
Surficial geology, water use, streamflow, aquifers,
water yields, water levels, water quality, and
recreational use are shown by maps. (Knapp-
USGS)
W69-07514

ROUND VALLEY RESERVATION SPRUCE RUN RESERVATION.
For primary bibliographic entry see Field 06E.
W69-07588

WATERS AND WATER SUPPLY.

N J Stat Ann secs 58:22-1 to 58:22-4 (1966).

Descriptors: *New Jersey, *Delaware River,
*Reservoirs, *Water storage, Water resources
development, Legislation, Water policy, Water
management (Applied), Dams, Watersheds
(Basins), Planning, Construction, Costs, Feasibility
studies, Streamflow, Water works, Water supply,
Reservoir construction, Reservoir sites, Adminis-
trative agencies.
Identifiers: *Raritan River.

In order to augment natural water resources and to
provide for a long-range program of development
the Department of Conservation is authorized to
expend $39,500,000 from the New Jersey Water
Bond Act, 1958, for: (1) a 55 billion gallon reser-
voir in Round Valley, the source of waters for

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which is to be the south branch of the Raritan River or the Delaware River; (2) a 10 billion gallon reservoir to be constructed by dams on Spruce Run and Mulhockaway Creek, tributaries of the Raritan River; (3) carrying out a 10 year program of geological and hydrological studies to determine ground-water resources; (4) determining the feasibility of utilizing ground-water storage to supplement reservoir storage as a source of water supply; (5) continuing to design means of improving stream flow in the Raritan and Millstone Watersheds and to acquire real property pursuant thereto; and (6) continue to design means to improve stream flow in any other area. The terms 'department,' 'construct,' 'cost,' 'commissioner', 'council,' 'division,' 'net revenues,' 'operating expenses,' 'project,' 'real property,' and 'water supply facility' are defined for purposes of the act. (Kahle-Fla)
W69-07679

3C. Use of Water of Impaired Quality

PRODUCTIVIZATION OF SAND DESERTS BY SALINE AND MARINE AGRICULTURE,
World Academy of Art and Science, Rehovoth (Israel).
Hugo Boyko, and Elisabeth Boyko.
International Conference on Arid Lands in a Changing World, Arizona University, Tucson, June 3-13, 1969. 9 p, 3 ref.

Descriptors: *Arid lands, *Deserts, *Salt tolerance, *Saline Water, *Sea water, Salinity, Germination, Osmotic pressure, Plant physiology, Brines, Water resources development, Land reclamation, Irrigation practices, Crop response, Soil-water-plant relationships.
Identifiers: *Saline agriculture, *Marine agriculture.

This is a review of the authors' and others' work, with recommendations for worldwide implementation. About 40 economic species have been grown with saltwater up to oceanic concentration, in various countries, and more than 250 species with saline waters, mainly desert underground waters with a total salt concentration of 2,000 to 10,000 p.p.m.T.D.S. Recent experiments proved that seedlings will grow at higher salt concentrations than before thought when many varieties of each species are tested. Fresh water for germination and growth of seedlings is advisable, but more study is needed on salt-sensitivity stages of cultivated plants. Juncus arabicus germinates in waters up to 9,000 p.p.m. chlorine. Juncus seedling growth is enhanced under plastic cover because the tiny plants are sheltered against wind, benefit from higher temperature, and if irrigated with saline water, have freshwater from the dropping air moisture. Desert underground waters have a lower salinity than sea water, but a less favorable ionic balance. Evaluation is made of the ecological and physiological approaches to problems of arid lands agriculture. New principles are listed. Programs are outlined for the utilization of these findings on a worldwide scale. (Sherbrooke-Ariz)
W69-07346

TRICKLE IRRIGATION - A METHOD FOR INCREASED AGRICULTURAL PRODUCTION UNDER CONDITIONS OF SALINE WATER AND ADVERSE SOILS,
Hebrew Univ., Jerusalem (Israel).
For primary bibliographic entry see Field 03F.
W69-07348

3D. Conservation in Domestic and Municipal Use

WATER RESOURCE DEVELOPMENT.
For primary bibliographic entry see Field 06E.
W69-07283

MUNICIPAL WATER PROBLEMS - SOME LEGAL ASPECTS,
For primary bibliographic entry see Field 06E.
W69-07452

THE ECONOMIC IMPLICATIONS OF THE INTERCONNECTION OF URBAN WATER SYSTEMS,
Temple Univ., Philadelphia.
For primary bibliographic entry see Field 06B.
W69-07468

3E. Conservation in Industry

LEASING OF OYSTER BEDS.

Del Code Ann tit 7, sec 4515 (1953).

Descriptors: *Delaware, *Oysters, *Mollusks, *Administrative agencies, Animals, Benthic fauna, Commercial shellfish, Marine animals, Shellfish, Clams, Mussels, Legislation, Regulation, Leases, Food, Oceans, Beds, Beds under water.
Identifiers: *Oyster beds, Oyster plantations.

The State Highway Department shall not lease any land used as an oyster plantation, oyster bed or oyster bottom. Nor shall the Department demise any land the use of which would affect any adjacent oyster plantation, bed or bottom in the planting, propagation or taking of oysters. (Helwig-Fla)
W69-07694

FISH.

Vt Stat Ann tit 10, secs 101-111 (Supp 1968).

Descriptors: *Vermont, *Fish management, *Fish conservation, *Fishing gear, Regulation, Legislation, Sport fishing, Fishing, Ice fishing, Nets, Hunting, Trapping, Permits, Trout, Carp, Salmon, Minnows, Suckers, Recreation, Bait fishing, Water sports, Equipment.
Identifiers: Spear fishing, Bow fishing, Bowfin, Pickerel.

Fish may be taken at any hour during the open season by use of not more than two lines per person each with one baited hook, no more than three artificial flies, or one plug, lure, or spoon. In waters other than closed trout waters two hooks may be used. Fish may be taken through the ice with not more than eight lines, tip ups or bobs, which shall be visited at least once an hour. Minnows may be taken in waters not inhabited by trout with nets not exceeding 75 feet. In trout water minnows may be taken by minnow traps not in excess of 18 inches in length with the opening not in excess of one inch. Carp, garfish, bowfin or suckers may be speared and pickerel shot by persons with hunting or combination licenses during the season provided therefor. Carp may be taken by persons with fishing or combination licenses, in the proper season, by bow and arrow with line attached. Fish may not be taken within 500 feet of waterfalls during spawning seasons of trout and salmon. Dealers in imported trout must keep their license displayed and containers labeled with the name of the supplier and kind, number and net weight of fish therein. (Kahle-Fla)
W69-07698

PRIVATE PRESERVES.

Vt Stat Ann tit 10, secs 5201-5211a (Supp 1968).

Descriptors: *Vermont, *Fish management, *Fish conservation, *Breeding, Fishing, Permits, Regulation, Legislation, Hunting, Trapping, Ponds, Streams, Fisheries, Fish farming, Fish stocking, Wildlife management, Number fish per acre.
Identifiers: *Private game preserves, Penalties, Posting.

An owner, or persons having the exclusive right to take fish or wild animals upon land or waters thereon, may prohibit hunting and fishing by pos ing notices on the land. Notices prohibiting fishin must show the date the water was last stocked an shall be maintained on the shoreline not over 40 feet apart. Posting must be recorded annually wit the town clerk. A notice prohibiting fishing ma not be maintained for more than one year after th waters were last stocked with 1,000 fry, 600 ac vanced fry, 3000 fingerlings, or 150 fish, for eac half mile of stream or acre of pond. Fines are im posed for taking game on posted land and fc damaging notices. The commissioner may issu licenses to breed fish and wild animals for one yea upon application and payment of $2.00 fee. breeder may sell fish and animals for propagatio or food during seasons prescribed by the commis sioner. Such fish and animals must be tagged c marked as the commissioner prescribes. A perso owning a pond of less than 20 acres stocked at h own expense and with no access to other wate may take fish from such pond at any time. Persor taking game from or damaging breeding farms sha be liable in tort to the owner. (Kahle-Fla)
W69-07699

3F. Conservation in Agriculture

PROBLEMS OF MANAGEMENT OF IRRIGA TION AND DRAINAGE WATERS IN THE SA LUIS UNIT, CENTRAL VALLEY PROJECT CALIFORNIA,
Bureau of Reclamation, Sacramento, Calif.
John W. Bailey.
International Conference on Arid Lands in Changing World, Arizona University, Tucson, Jun 3-13, 1969. 40 p, 8 fig, 4 tab, 15 ref.

Descriptors: *Arid lands, *Irrigable land, Wate management, Water utilization, Saline soils, Sa balance, Permeability, Drainage water, Projec benefits, Project planning, Waste water disposa Salt tolerance, Irrigation water, Water quality Central Valley Project.
Identifiers: San Luis Unit, Central Valley Projec (Calif), San Joaquin Valley (Calif).

The San Luis Unit of the Central Valley Project c California now under construction by the Bureau of Reclamation will provide for irrigation develop ment of arid lands whose water supply is in adequate to support existing agriculture. Variou considerations of water management that relate t the project are discussed and pertinent data ar presented. Environmental features are discussed i sufficient detail to indicate some of the principl considerations in water quality management. Con trasting conditions are presented for permeabl well-drained and slowly permeable poorly-draine soils. Surface and groundwater criteria for mixin are discussed. Problems in prediction of salt bui dup and salt balance under a mixing regime ar considered. Mixing of irrigation water and disposa of drainage effluent are discussed in relation to th project. (Sherbrooke-Ariz)
W69-07343

THE ASPHALT MOISTURE BARRIER FOI FARMING DROUGHTY SOILS,
International Harvester Co., Chicago, Ill. Produc Planning Research; and American Oil Co., Whi ing, Ind. Research and Development Dept.
For primary bibliographic entry see Field 03B.
W69-07344

TRICKLE IRRIGATION - A METHOD FOR IN CREASED AGRICULTURAL PRODUCTIO UNDER CONDITIONS OF SALINE WATE AND ADVERSE SOILS,
Hebrew Univ., Jerusalem (Israel).
D. Goldberg, and M. Shmueli.
International Conference on Arid Lands in Changing World, Arizona University, Tucson, Jun 3-13, 1969. 24 p, 7 fig, 7 tab.

Descriptors: *Irrigation efficiency, Deserts, Cro response, Growth rates, Irrigation effects, Root dis

ition, Saline water, Distribution systems, Fur-
irrigation, Sprinkler irrigation, Subsurface ir-
ion, Water conservation, Saline soils.
tifiers: *Trickle irrigation.

paper reports on experiments employing drip
ation in the Arava desert region of Israel. The
nod is based on the lateral spread of water by
duction under pressure and application through
ial nozzles placed on a plastic conveyor pipe
above the ground in close proximity to the
ts. Experimental crops included musk melons,
atoes, cucumbers, sweet corn and peppers.
of growth under trickle irrigation surpassed
under sprinkler irrigation. This led to earlier,
ell as higher, yields with reduced production
, particularly water. Picking costs were
ced by uniform ripening and early market
es were higher. In many cases, under trickle ir-
ion, the salt concentration was the lowest
ible under the specific prevailing conditions of
e water and saline soils of the area. Values for
ride content in plant leaves under trickle irriga-
were between 40 to 60% of those for sprinkler
ation. With very low rates of application the
r supply very nearly equals the amount ac-
y used by the plant. (Sherbrooke-Ariz)
-07348

**BLEMS OF POLLUTION OF IRRIGATION
TERS IN ARID REGIONS,**
State Univ., Logan. Dept. of Agricultural and
ation Engineering; and Federal Water Pollu-
Control Administration, Ada, Okla.
primary bibliographic entry see Field 05B.
-07355

**SIBILITIES FOR REMOTE DETECTION
WATER IN ARID AND SUBARID LANDS
IVED FROM SATELLITE MEASURE-
NTS IN THE ATMOSPHERIC WINDOW 3.5-
mu,**
onal Aeronautics and Space Administration,
enbelt, Md. Goddard Space Flight Center.
primary bibliographic entry see Field 07B.
-07356

**MPARISON OF IRRIGATION METHODS IN
ARID ENVIRONMENT,**
fornia Univ., Davis. Dept. of Water Science
Engineering.
k E. Robinson, and William F. Lehman.
rnational Conference on Arid Lands in a
nging World, Arizona University, Tucson, June
, 1969. 10 p, 4 fig, 12 ref.

criptors: *Sprinkler irrigation, *Irrigation effi-
cy, *Arid lands, Water conservation, Soil-
er-plant relationships, Water cooling, Water
zation efficiency, Flood irrigation.
tifiers: Imperial Valley (Calif).

face irrigation presently in use in the arid
orado Desert, California, agricultural area was
eloped when water was adequate for luxury
sumption, but present expansion of human
ulation necessitates increased water use effi-
cy. Surface and sprinkler irrigation were stu-
in terms of changes in vapor pressure, plant
perature and soil temperature. Changes in
or pressure were most pronounced in the sprin-
system, but did not persist at night. Both types
rrigation reduce plant temperature, but plants
med cyclic temperature regimes afterwards.
surface temperature was reduced to a greater
nt by sprinkler irrigation because the applied
er was cooled by movement through air of low
or pressure. Other advantages of sprinkler ir-
tion are enumerated. (Sherbrooke-Ariz)
-07357

**IGATION AS A MENACE TO HEALTH IN
LIFORNIA: A NINETEENTH CENTURY
EW,**
ifornia Univ., Davis. Dept. of Geography.
primary bibliographic entry see Field 06B.

W69-07372

HYDROGEOLOGIC CONSIDERATIONS IN LIQUID WASTE DISPOSAL,
Wisconsin Univ., Madison. Dept. of Geology.
For primary bibliographic entry see Field 05E.
W69-07375

EVALUATING RANGELAND WATER QUALITY WITH SMALL PLOT INFILTROMETERS,
Utah State Univ., Logan. Dept. of Watershed Science; and Intermountain Forest and Range Experiment Station, Ogden, Utah.
Gerald F. Gifford, and Ronald K. Tew.
J Soil and Water Conserv, Vol 24, No 2, pp 65-67, Mar-Apr 1969. 3 p, 1 fig, 2 tab, 2 ref.

Descriptors: *Infiltrometers, *Water quality, *Range management, Brush control, Clear-cutting, Irrigation practices, Runoff, Infiltration, Arid lands.
Identifiers: Rocky Mountain infiltrometer.

Use of small plot infiltrometers allows collection and analysis of both applied and runoff water in evaluating rangeland water quality changes caused by agricultural disturbance of soil. In experimental plots, a natural cover of pinyon and juniper was removed by chaining and debris was cleared in one plot, another was chained but not cleared, and a third plot was left undisturbed. A Rocky infiltrometer was used to apply high intensity rainfall on each plot at over 2.7 in/hr. Significant changes in Ca and K concentrations resulted from land treatment. The pH of all runoff from treated plots decreased, and electrical conductivity increased. There was no relationship between runoff water quality and volume or duration of runoff. (Knapp-USGS)
W69-07377

PRINCIPLES AND METHODS OF CAPACITY DETERMINATION IRRIGATION DISTRIBUTION SYSTEMS,
Middle East Technical Univ., Ankara (Turkey).
Korkut Ozal.
Middle East Tech Univ, Fac of Eng Publication No 22, Jan 1965. 138 p, 55 fig, 29 tab, 128 ref.

Descriptors: *Irrigation systems, *Irrigation design, *Irrigation water, *Water supply, Mathematical studies, Water demand, Evapotranspiration, Water circulation, Climates, Dynamics, Economic aspects, Plants, Soils, Water loss, Frequency, Probability, Experimental farms.
Identifiers: *Irrigation distribution systems, Irrigation system design, Irrigation system analysis.

After stating that the capacities of irrigation canals are determined by several parameters, such as the type of crops under cultivation, the soil, the type of irrigation system used, etc., the author develops a detailed analysis of these parameters mainly based on the analytical and experimental studies conducted by several earlier investigators. The book contains 128 references and consists of the following chapters: (1) introduction; (2) a review of the factors that affect system capacities (water requirements of plants, soil characteristics, system losses, system operation, economic aspect); (3) the principles of system designs (general, water duty, system flexibilities); and (4) conclusions. (Gabriel-USGS)
W69-07421

REDUCTION OF WATER APPLICATION LOSSES THROUGH IMPROVED DISTRIBUTION CHANNEL DESIGN,
Oklahoma Agricultural Experiment Station, Stillwater.
James E. Garton, and John M. Sweeten, Jr.
Technical Completion Report, Water Resources Research Institute, August 19, 1968. 53 p, 5 tab, 12 fig, 16 ref. OWRR Project No. A-004 Okla.

Descriptors: *Irrigation canals, *Irrigation design, *Laboratory tests, Furrow irrigation, Irrigation engineering, Hydraulic engineering, Open channels, Mannings equation.

These studies were directed toward improving the uniformity of application of water with furrow irrigation. Increased efficiency of application can best be achieved by improving uniformity. Values of Manning's n were obtained with gradually varied flow in a level ditch without siphon tubes with different diameters, spacing, and submergence. Relationships of Manning's n to the variables were determined. The tubes were primed and values of Manning's n were determined for various diameters, spacing, and submergence with spatially varied flow. The results of these studies were used to determine the uniformity of water application which could be expected with various ditch slopes and outlet arrangements. A method was derived for calculating the water surface elevations at various points in a level distribution bay without resorting to a computer solution. Various diameters of circular weirs and orifices were studied to determine the head-discharge relationship for weirs with a 45 degree slope operating as side discharge devices. Rectangular weirs of various length were studied to determine the head-discharge relationship for weirs with a 45 degree slope.
W69-07474

HYDROLOGIC RESPONSE TO IRRIGATION PUMPING IN HUALAPAI FLAT, WASHOE, PERSHING, AND HUMBOLDT COUNTIES, NEVADA, 1960-67,
Geological Survey, Carson City, Nev.
For primary bibliographic entry see Field 04B.
W69-07501

IRRIGATION IN THE RHODESIAN LOWVELD,
University Coll. of Fort Hare (South Africa). Dept. of Geography.
N. C. Pollock.
The Geogr J, Vol 134, Part 1, pp 70-77, Mar 1968. 8 p, 4 fig, 1 tab, 7 ref.

Descriptors: *Irrigation, *Irrigation engineering, *Crop production, Rainfall, Climatic zones, Water resources, Water supply, Precipitation (Atmospheric), Topography, Temperature, Soils, Mapping, Rivers, Dams, Mineral industry, Sugar crops, Watersheds (Basin), Economics.
Identifiers: Rhodesian lowveld irrigation.

After describing the geology and history of the development of the irrigation system in the lowlands of Rhodesia located in the southeastern strip bordered by Transvaal and Mozambique the author discusses the present status of agriculture and land irrigation existing in the lowlands. The future dam construction and irrigation projects to increase the agricultural economy of the area are also briefly discussed. (Gabriel-USGS)
W69-07527

WATER CONSERVATION AND IRRIGATION AGENCIES.

Ala Code tit 12, secs 297 (1) -- 297 (14) (Supp 1967).

Descriptors: *Alabama, *Water conservation, *Irrigation programs, *Irrigation districts, Legislation, Administrative agencies, Local governments, Contracts, Bids, Water supply, Impoundments, Wells, Flood control, Surplus water, Multiple purpose projects, Water rates, Water users, Taxes, Permits, Erosion control, Water management (Applied), Water resources development, Eminent domain, Soil erosion.

A state development agency, constituting an irrigation district, is authorized in the interest of conservation and irrigation. Counties may elect to become a part of the agency, the membership of which shall consist of title holders of land to be irrigated. The method of incorporating the agency and the procedures to be followed in its operation are provided. Among the power of the agency are the powers: (1) to contract; (2) to sue and be sued; (3) to enter agreements with the United States concerning water impounded by it; (4) to acquire pro-

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perty; (5) to provide a water supply; (6) to develop and operate an irrigation project; (7) to provide for flood control; (8) to provide multiple purpose developments; (9) to establish rates for water sold; (10) to tax water users; (11) to control soil erosion and silt; and (12) to exercise the right of eminent domain. Prior to any construction, the department of conservation must issue a permit. Contracts for construction and purchases of materials are to be awarded on the basis of competitive bids. Bonds may be issued for the purpose of finance. (Childs-Fla)
W69-07620

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

JOHNSON V AGERBECK (SURFACE WATERS).
For primary bibliographic entry see Field 06E.
W69-07328

ILLINOIS CENTRAL RAILROAD CO V GEORGE (DIVERSION OF SURFACE WATERS).
For primary bibliographic entry see Field 06E.
W69-07333

FLOOD PLAIN INFORMATION OF SOUTH FORK PALOUSE RIVER AND MISSOURI FLAT CREEK, PULLMAN, WASHINGTON.
Corps of Engineers, Walla Walla, Wash.

Corps Eng Flood Plain Rep, Apr 1969. 34 p, 11 fig, 13 plate, 3 tab.

Descriptors: *Floods, *Flood damage, *Washington, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Pullman (Wash), Palouse River (Wash), Missouri Flat Creek (Wash), Standard project flood, Intermediate regional flood.

Flooding of the South Fork Palouse River and Missouri Flat Creek, Pullman, Washington is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-07370

MAN-MADE LANDFORMS IN THE NILE DELTA,
Texas Univ., Austin. Dept. of Geography.
Robert K. Holz.
Geogr Rev, Vol 59, No 2, pp 253-269, Apr 1969. 17 p, 12 fig, 19 ref.

Descriptors: *Deltas, *Land forming, *Topography, *River basin development, *Geomorphology, Human population, Agriculture, Climates, History, Maps, Deserts, Gaging stations, Precipitation (Atmospheric), Rice, Cotton, Fruit crops, Evapotranspiration, Soils, Water table.
Identifiers: *Egypt, Nile delta koms.

This paper describes the low mounds, the so-called koms, of the Nile delta, which are the accumulated debris of thousands of years of human occupation. After giving the recent map of the Mendes site, the author discusses the delta and kom landscapes, their vegetation, soil, water table, and human occupance. The author summarizes his study by stating that the koms stand out in the landscape as distinct units, both physically and culturally, and that a sharp contrast between the unirrigated koms and surrounding lush vegetation constantly reinforces the delta farmer's awareness of his dependence on the waters of the Nile River. (Gabriel-USGS)
W69-07373

SOME ENVIRONMENTAL EFFECTS OF DRAINAGE IN FLORIDA,
Central and Southern Florida Flood Control District, West Palm Beach.
William V. Storch, and Robert L. Taylor.
ASCE Proc, J Irrig and Drainage Div, Vol 95, No IR1, Pap 6460, pp 139-151, Mar 1969. 13 p, 6 fig.

Descriptors: *Drainage, *Wetlands, *Florida, *Environmental effects, Citrus fruits, Economics, Estuaries, Flood control, Irrigation, Sedimentation, Water quality, Fish, Ecology, Plants, Social aspects, Conservation, Public rights.
Identifiers: Lake Okeechobee-Everglades Basin (Fla).

In 1959, intensive agricultural development started in a 780 sq mi region lying east of Lake Okeechobee in south Florida. In this 'wetland' region of flats, sloughs and ponds effective drainage to coastal waters has been the key to agricultural expansion. By 1967 approximately 20% of the region was planted in citrus. Changes in the natural environment within the region took place almost immediately after drainage was initiated and indicates that the natural environment in adjacent areas can be affected as well. The effect of drainage on the immediate economic environment of the region has been favorable to date. However, natural environmental changes have produced tensions, with economic overtones, in the social environment resulting in conflict between agricultural and conservationist interests. Based on the experience gained in this region it is suggested that the proper function of public government is to evaluate the possible environmental effects of drainage programs and to use its financial, persuasive and regulatory powers to guide total environmental change in accordance with its estimate of the best public interest. (Knapp-USGS)
W69-07382

FLOOD PLAIN INFORMATION, CEDAR RIVER, RENTON, WASHINGTON.
Corps of Engineers, Seattle, Wash.

Corps Eng Flood Plain Rep, Mar 1969. 34 p, 5 fig, 26 plate, 8 tab.

Descriptors: *Floods, *Flood damage, *Washington, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Renton (Wash), Cedar River, Standard project flood, Intermediate regional flood.

Flooding of the Cedar River, Renton, Washington is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-07384

SPATIAL ORDER IN FLUVIAL SYSTEMS: HORTON'S LAWS DERIVED FROM MIXED HEXAGONAL HIERARCHIES OF DRAINAGE BASIN AREAS,
Harvard Univ., Cambridge, Mass. Computer Graphics and Spatial Analysis Lab.
Michael J. Woldenberg.
Geol Soc Amer Bull, Vol 80, No 1, pp 97-111, Jan 1969. 15 p, 3 fig, 6 tab, 44 ref, 1 append.

Descriptors: *Drainage density, *Drainage patterns (Geologic), *Mathematical models, Geomorphology, Computer models, Digital computers, Streams, Streamflow, Hydraulics, Thermodynamics, Entropy, Topography.
Identifiers: Hortons law, Topology, Allometric growth, Geometry.

The number of stream basin areas (that is, the number of Strahler stream segments) is predicted on the basis of a hexagonal model for basin areas. It is suggested that the number of orders and the number of basins per order balance opposing tendencies for minimum overland work for streams flowing in small basins and maximum work savings in large, as opposed to small, channels. In addition, the entropy of the system approaches the maximum possible. The model agrees with empirical data in cases where the land surface is reasonably uniform with regard to structure and lithology. The necessity for approximate geometric progressions of basin areas with order creates geometric progressions of other basin parameters, leading directly to the power function relationships between variables known as allometric growth. This model is identical to one proposed to explain the numbers of market areas per order in a system of cities. (Knapp-USGS)
W69-07394

THE WILLAMETTE RIVER, FLOOD CONTROL OR FLOOD MANAGEMENT,
Oregon State Univ., Corvallis. Dept. of Agricultural Economics.
Daryll Raitt.
Natur Resources J, Vol 9, No 1, pp 35-52, Jan 1969. 18 p, 3 fig, 2 tab, 14 ref.

Descriptors: *Flood control, *Flood protection, *Water management (Applied), *Oregon, Flood plain insurance, Legal aspects, Social aspects, Governments, Legislation, Economics, Flood damage, Non-structural alternatives.
Identifiers: Willamette River (Oreg).

The past effectiveness of flood control programs on the Willamette River, Oregon are evaluated, the predicted effectiveness of authorized projects without other management practices is estimated, conditions for efficient flood management are outlined, and recommendations for flood management programs are made. The data used are from 2 U.S. Army Corps of Engineers reports on flood heights and damages in the area. The effects of structures in alleviating damages are shown graphically. The use of management or non-structural alternatives is stressed. (Knapp-USGS)
W69-07395

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS, IN NEBRASKA.
Corps of Engineers, Omaha, Nebr. Missouri River Div.

Corps Eng Water Resources Develop Rep, Jan 1969. 33 p, 14 photo, 2 map, index.

Descriptors: *Water management (Applied), *Nebraska, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U.S. Army Corps of Engineers projects (Nebr).

U.S. Army Corps of Engineers water resource development projects in Nebraska are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply

r pollution, power, recreation, and flood plain
es. (Knapp,USGS)
-07397

TER RESOURCES DEVELOPMENT BY
U.S. ARMY CORPS OF ENGINEERS IN
TH DAKOTA.
s of Engineers, Omaha, Nebr. Missouri River

s Eng Water Resources Develop Rep, Jan
. 21 p, 1 map, 5 photo, index.

riptors: *Water management (Applied),
th Dakota, *Water resources development,
gation, River basin development, Flood con-
Multiple-purpose projects, Hydroelectric
r, Dams, River training.
ifiers: U.S. Army Corps of Engineers projects
).

Army Corps of Engineers water resources
lopment projects in North Dakota are listed.
role of the Corps of Engineers in planning and
ling water resources improvements is
ribed briefly, and the procedure for initiating
studies, authorization procedures, and status
ojects are outlined. Projects described include
gation, flood control, multiple-purpose pro-
, river surveys, erosion control, water supply,
r pollution, power, recreation, and flood plain
es. (Knapp-USGS)
-07398

TER RESOURCES DEVELOPMENT BY
U.S. ARMY CORPS OF ENGINEERS IN
O.
s of Engineers, Huntington, W. Va. Ohio
r Div.

s Eng Water Resources Develop Rep, Jan
. 101 p, 2 map, 35 photo, index.

riptors: *Water management (Applied),
io, *Water resources development, Naviga-
River basin development, Flood control, Mul-
-purpose projects, Hydroelectric power, Dams,
r training.
ifiers: U.S. Army Corps of Engineers projects
o).

Army Corps of Engineers water resources
lopment projects in Ohio are listed. The role of
Corps of Engineers in planning and building
r resources improvements is described briefly,
the procedure for initiating such studies,
orization procedures, and status of projects are
ned. Projects described include navigation,
d control, multiple-purpose projects, river sur-
, erosion control, water supply, water pollu-
power, recreation, and flood plain studies. (K-
-USGS)
-07399

TER RESOURCES DEVELOPMENT BY
U.S. ARMY CORPS OF ENGINEERS IN
AHOMA.
s of Engineers, Dallas, Tex. Southwestern Div.

s Eng Water Resources Develop Rep, Jan
. 64 p, 4 fig, 4 map, 24 phot, index.

riptors: *Water management (Applied),
lahoma, *Water resources development,
gation, River basin development, Flood con-
Multiple-purpose projects, Hydroelectric
r, Dams, River training.
ifiers: U.S. Army Corps of Engineers projects
la).

Army Corps of Engineers water resources
lopment projects in Oklahoma are listed. The
of the Corps of Engineers in planning and
ding water resources improvements is
ribed briefly, and the procedure for initiating
studies, authorization procedures, and status
of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-07400

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN OREGON.
Corps of Engineers, Portland, Oreg. North Pacific Div.

Corps Eng Water Resources Develop Rep, Jan 1969. 85 p, 3 fig, 3 map, 100 photo, index.

Descriptors: *Water management (Applied), *Oregon, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U.S. Army Corps of Engineers projects (Oreg).

U.S. Army Corps of Engineers water resources development projects in Oregon are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-07401

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN PUERTO RICO AND THE VIRGIN ISLANDS.
Corps of Engineers, Atlanta, Ga. South Atlantic Div.

Corps Eng Water Resources Develop Rep, Jan 1, 1969. 27 p, 1 map, 34 photo, index.

Descriptors: *Water management (Applied), *Puerto Rico, Virgin Islands, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U.S. Army Corps of Engineers projects (P. R. and V. I.).

U.S. Army Corps of Engineers water resources development projects in Puerto Rico and the Virgin Islands are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and the status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-07402

THE EFFECT OF THE BEGINNING OF A HYDROLOGICAL YEAR ON THE STATISTICAL PARAMETERS OF STREAMFLOW AND REQUIRED RESERVOIR CAPACITY (RUSSIAN),
Nauchno-Issledovatelskii Gidroenergeticheskii Institut, Tiflis (USSR).
For primary bibliographic entry see Field 02E.
W69-07403

FLOODS IN RICHMOND QUADRANGLE, NORTHEASTERN ILLINOIS,
Geological Survey, Washington, D. C.
Roman T. Mycyk, and Gerald L. Walter.
Geol Surv Hydrol Invest Atlas HA-303, 1 sheet, 1969. Text, 7 fig, 3 tab, 4 ref.

Descriptors: *Floods, *Illinois, *Stage-discharge relations, Streamflow, Surface waters, Hydrologic data, Duration curves, Flood plains, Peak discharge.
Identifiers: *Richmond (Ill), Flood frequencies.

Hydrologic data are presented to be used to evaluate the extent, depth, and frequency of flooding in the Richmond quadrangle, northeastern Illinois. The areas inundated by floods are shown on a topographic map. Flood heights are tabulated. Flood discharges, frequencies, recurrence intervals, and depths are shown graphically. (Knapp-USGS)
W69-07405

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS, IN MONTANA.
Corps of Engineers, Omaha, Nebr. Missouri River Div.

Corps Eng Water Resources Develop Rep, Jan 1969. 19 p, 4 fig, 7 photo, 1 map, index.

Descriptors: *Water management (Applied), *Montana, *Water resources development, Navigation, River basin development, Flood control, Multiple purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U S Army Corps of Engineers projects (Montana).

U.S. Army Corps of Engineers water resources development projects in Montana are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-07495

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN MISSOURI.
Corps of Engineers, Omaha, Nebr. Missouri River Div.

Corps Eng Water Resources Develop Rep, Jan 1969. 74 p, 27 photo, 1 map, index.

Descriptors: *Water management (Applied), *Missouri, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U.S. Army Corps of Engineers projects (Missouri).

U. S. Army Corps of Engineers water resources development projects in Missouri are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-07496

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN LOUISIANA.
Corps of Engineers, Vicksburg, Miss. Lower Mississippi Valley Div.

Corps Eng Water Resources Develop Rep, Jan 1969. 133 p, 4 fig, 10 map, 80 photo, 5 tab, index.

Descriptors: *Water management (Applied), *Louisiana, *Water resources development,

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Navigation, River basin development, Flood control, Multiple,purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U.S. Army Corps of Engineers projects (Louisiana).

U.S. Army Corps of Engineers water resources development projects in Louisiana are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-07497

WATER RESOURCES DEVELOPMENT BY U.S. ARMY CORPS OF ENGINEERS IN KENTUCKY.
Ohio River Div. Labs., Mariemont.

Corps Eng Water Resources Develop Rep, 1969. 86 p, 1 fig, 3 map, 35 photo, 1 tab, index.

Descriptors: *Water management (Applied), *Kentucky, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U.S. Army Corps of Engineers projects (Kentucky).

U.S. Army Corps of Engineers water resources development projects in Kentucky are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-07498

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN KANSAS.
Corps of Engineers, Dallas, Tex. southwestern Div.

Corps Eng Water Resources Develop Rep, Jan 1969. 80 p, 2 fig, 4 map, 29 photo, index.

Descriptors: *Water management (Applied), *Kansas, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U.S. Army Corps of Engineers projects (Kansas).

U.S. Army Corps of Engineers water resources development projects in Kansas are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-07499

RECONNAISSANCE OF THE RED LAKE RIVER, MINNESOTA,
Geological Survey, Washington, D. C.
L. H. Roper, R. F. Brown, and D. E. Wheat.
Geol Surv Hydrol Invest Atlas HA-299, 2 sheets, 1969. 13 fig, 6 map, 3 photo, 4 tab, 14 ref.

Descriptors: *Surveys, *Hydrology, *Recreation, *Rivers, *Minnesota, Streamflow, Hydrographs, Floods, Water quality, Sediment load, Water utilization, Navigation, Industries, Cities.
Identifiers: Red Lake River (Minn).

Results of a reconnaissance study of 185 miles of the Red Lake River, Minnesota are presented in a 2-sheet hydrological atlas consisting of maps, charts, graphs, photographs, and text. The information is intended for educators, scientists, planners, and anyone who wishes to enjoy travel on the river. Physical character, recreation sites, geology, and vegetation are shown by maps and cross sections. Streamflow is summarized in hydrographs and recession curves. Water quality is shown graphically. General discussions are given of the river, its history, hydrology, water quality, and the area's geology. (Knapp-USGS)
W69-07505

FLOOD PLAIN INFORMATION OF GRAND RIVER, INGHAM COUNTY AND EATON COUNTY, MICHIGAN.
Corps of Engineers, Detroit, Mich.

Corps Eng Flood Plain Rep, 1969. 41 p, 6 fig, 25 plate, 12 tab.

Descriptors: *Floods, *Flood damage, *Michigan, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Grand River (Mich), Ingham County, Eaton County, Standard project flood, Intermediate regional flood.

Flooding of the Grand River, Ingham and Eaton Counties, Michigan is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-07509

FLOOD PLAIN INFORMATION OF BLACK RIVER, SPRINGIELD, VERMONT.
Corps of Engineers, Waltham, Mass. New England Div.

Corps Eng Flood Plain Rep, 1969. 41 p, 8 fig, 14 plate, 4 tab.

Descriptors: *Floods, *Flood damage, *Vermont, Flood plains, Flood control, Non-structural alernatives, Maximum probable flood, Historic flood.
Identifiers: Springfield (Vermont), Black River (Vermont), Standard project flood, Intermediate regional flood.

Flooding of the Black River, Springfield, Vermont is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-07510

IRRIGATION IN THE RHODESIAN LOWVELD,
University Coll. of Fort Hare (South Africa). Dept. of Geography.
For primary bibliographic entry see Field 03F.
W69-07527

GENERAL CONTROL OF A GROUP O RESERVOIRS AND THE OPTIMUM DISTRIBU TION OF WATER RESOURCES (JAPANESE),
Tokyo Univ. (Japan). Dept. of Civil Engineering.
Yutaka Takahasi, Kuniyoshi Takeuchi, and Takashi Okuma.
J Fac Eng, Tokyo Univ, Ser A, Annu Rep No 6, p 6-7, 1968. 2 p, 1 fig, 2 ref.

Descriptors: *Water resources, *Water contro *Reservoir storage, Reservoir yield, Wate shortage, Floods, Water distribution (Applied Water balance, Optimum development plan Technical feasibility, Mathematical studie Aquifers.
Identifiers: Reservoirs group control, Optimum di tribution of water resources.

Because there is almost no research pertaining t the optimum operation procedures of existir water-resource systems, the authors developed a optimum operation procedure on the basis of som analytical concepts and hydrological data recorde in Japan. The optimum operation procedures of group of water reservoirs are based on the use 'Expected Days' and 'Priority Index' conception (Gabriel-USGS)
W69-07534

JOHNSON V WILLS (DRAINAGE OVER AI JACENT PROPERTY).

220 So 2d 134-136 (La Ct App 1969).

Descriptors: *Louisiana, *Land tenure, *Surfac drainage, *Prescriptive rights, Ditches, Drainag practices, Surface waters, Obstruction to flo Natural flow, Watershed (Divides), Legal aspect Judicial decisions, Drainage patterns (Geologic Remedies, Relative rights.
Identifiers: Injunctions (Prohibitory).

The plaintiff and the defendant were adjacent la downers. The plaintiff sought an injunction orde ing the defendant to remove dirt from a drainag ditch on the defendant's land which obstructed th natural drainage of the plaintiff's land. The defe dant claimed that the natural drainage of the plai tiff's land was not across the defendant's propert The court held that the evidence showed the nat ral drainage of the plaintiff's property to be ov the defendant's land and that the plaintiff's lar had drained in that manner for more than ten year The court stated that a lower landowner m acquire by acquisitive prescription a convention servitude of drainage over land situated above. Th court found that this servitude is permanent acquired after a ten year period. The court he that the plaintiff's prescriptive rights had accrue and that he was entitled to injunctive relie (Shevin-Fla)
W69-07586

WATER RESOURCES COMMISSION.

Conn Gen Stat Ann sec 25-1 thru 25-9 (1958), amended, (Supp 1968).

Descriptors: *Connecticut, *Water pollutio *Flood control, *Water policy, Water resourc development, Administrative agencies, Sta governments, Permits, Flood damage, Channe Channel improvement, Erosion, Beach erosio Shore protection, Navigation, Navigable wate Harbors, Rivers, Islands, Tidal waters, Coast Water utilization, Wells, Legislation, Legal aspect High water mark.

The creation of the State Water Resources Cor mission is authorized and its general powers a delineated. These powers relate to flood contr water resource development, shore erosion, a construction of dams, dikes, piers, and reservoi The commission is responsible for maintaining th navigability of the state's channels and oth navigable waters and, with other state agencies, empowered to formulate long range plans for th

ervation and improvement of water resources. ner, the commission is given some control over naintenance of municipal water reserves and rilling of wells in the state. (Kelly-Fla)
-07594

TER RESOURCES COMMISSION.
n Gen Stat Ann secs 25-1 to 25-2 (1958), as nded, (Supp 1968).

riptors: *Connecticut, *Water pollution, od control, *Water policy, Water resources lopment, Administrative agencies, State rnments, Permits, Flood damage, Channels, nel improvement, Erosion, Shore protection, l waters, Navigation, Dikes, Dams, Legislation, l aspects, Regulation, Pollution abatement.

Water Resources Commission is established urposes of planning and coordinating activities erning abatement of pollution, flood control, e erosion, water policy, and problems involving truction of dams, dikes, and reservoirs. The bership of the commission represents the fol- g interests: (1) the state department of health; agriculture; (3) fish, wildlife and recreation; manufacturing; (5) electric or water utilities; nunicipalities; and (7) the public at large. The mission may make use of the facilities of the cultural Experiment Station and cooperate any other public or private agency in carrying ts duties. Any commissioner, or any assistant mployee of the commission, may enter any ises at any reasonable time while engaged in rming his duty under the provisions of this act. y-Fla)
-07595

TER RESOURCES COMMISSION.
n Gen Stat Ann secs 25-3 to 25-4 (1958), as nded, (Supp 1968).

riptors: *Connecticut, *Water pollution, od control, *Water policy, Contracts, Naviga- Navigable waters, Channels, Channel im- ement, Investigations, Harbors, Rivers, Basins, l waters, Coasts, Legislation, Legal aspects, governments, United States, Weed control, l control.

Water Resources Commission is authorized to tiate and enter into agreements or compacts other states, and the United States, relative to l control, river and harbor improvements, ob- tions, navigation, pollution, diversion of in- ate waters and the use of such waters by state deral agencies. The commission is designated e shore erosion agency of the state for pur- s of the federal River and Harbor Act. The mission may conduct investigations and studies nditions along the shore line, harbors, rivers, islands within the state for protection and ncement of public and private interests. The mission may establish limits for obstruction of nels and waterways, and may make agree- ts with dam and reservoir owners regarding l control. The governor must make final ap- al of agreements contemplated by the commis- The commission is authorized to undertake e abatement and weed control programs. Fol- ng public hearings, the commission may gnate channels and boat basins in lands under or coastal waters for improvement of general gation and for access to deep water. (Kelly-

-07596

TER RESOURCES COMMISSION.
n Gen Stat Ann secs 25-4a to 25-6 (1958), as nded, (Supp 1968).

criptors: *Connecticut, *Water pollution, od control, *Water policy, Water utilization, er resources development, Administrative cies, Permits, Obstruction to flow, Erosion, sion, Legal aspects, Flood damage, Channels, Channel improvement, Beach erosion, Navigation, Regulation, Water quality control.

For protection of flood-prone areas, the commission may establish lines in streams and channels beyond which no obstruction will be permitted. The commission shall issue or deny construction permits based on findings of the effects of proposed encroachments on the flood-carry capacity of waterways, flood heights, and hazards to life and property. The commission may remove unauthorized or over-extended obstructions as public nuisances. The Water Resources Commission, together with the state department of health, the state board of fisheries and game, and the state development commission, is authorized to prepare a statewide, long range plan for the management of the state's water resources. The plan should include identification of quality and quantities of available water, present and projected demands, and recommended utilization of the water. The governor may require special reports upon any of these matters. (Kelly-Fla)
W69-07597

WATER RESOURCES COMMISSION.
Conn Gen Stat Ann secs 25-7a to 25-9 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *Water pollution, *Flood control, *Water policy, Wells, Water utilization, Administrative agencies, Channels, Channel improvement, Coasts, Tidal waters, Navigation, Navigable waters, Shore protection, Beach erosion, Legislation, Legal aspects, Water resources development, Water supply, Permits, Gaging stations.

Approval of the commission is required before any public water system may sell its water reserves in excess of those required to maintain an adequate supply. The commission is authorized to regulate the erection of structures and work incidental thereto in the tidal, coastal, or navigable waters of the state with due regard to prevention or alleviation of shore erosion, land development, and improvement of navigation. The commission may establish seaward boundaries beyond the high water mark along tidal and coastal waters for regulation of use and for providing small boat basins. Permits from the commission are required for construction along tidal or coastal waters. The commission is directed to establish and operate stream gauging stations for water resource investigation, and is authorized to permit municipalities to divert water from any river for public or domestic use. Persons engaging in well drilling operations must register with the commission. (Kelly-Fla)
W69-07598

THAMES RIVER VALLEY FLOOD CONTROL COMM'N.
Conn Gen Stat Ann secs 25-101 to 25-102 (1958).

Descriptors: *Connecticut, *Interstate compacts, *Flood control, *Interstate rivers, Legislation, Reservoirs, Reservoir sites, Damsites, Taxes, River basins, United States, Financing, Administration, Legal aspects, Massachusetts, Project purposes, Cost sharing, State governments.

The governor of Connecticut is authorized to enter into a compact with Massachusetts for the purpose of assuring adequate storage capacity for impounding the waters of the Thames River for the protection of life and property from floods. The Thames River Valley Flood Control Commission is created and is to consist of 6 members, 3 from each state. The powers of the Commission are enumerated. The Commission shall develop a plan for flood control and for utilization of the water resources of the Thames River Valley. The credit of the signatory states shall not be pledged by the Commission. Massachusetts has agreed to the construction by the United States of four dams and reservoirs in the Thames River Valley. Connecticut agrees to reimburse Massachusetts for 40 percent of the amount of taxes lost by reason of acquisition and ownership by the United States of lands for construction of the four dams or any other flood control dam hereafter constructed. If Massachusetts acquires lands for flood control purposes and is not fully reimbursed by the United States, Connecticut shall pay its share of the excess cost as determined by the Commission. Procedure for appointing 3 commissioners and their respective tenures is provided for in the act. (Holt-Fla)
W69-07601

NORTHEASTERN WATER AND LAND RESOURCES COMPACT.
onn Gen Stat Ann secs 25-120 to 25-121 (1958).

Descriptors: *Connecticut, *Interstate compacts, *Water resources development, *State governments, Legislation, Interstate commissions, Water policy, Interagency cooperation, Water resources, Water management (Applied), Federal government, Natural resources, Water sources, Employment, Contracts, Administrative agencies, Investigations, Surveys, Project planning.
Identifiers: Constitutionality.

The northeast section of the United States is a vast area of natural resources which may be exploited effectively only through a coordinated plan of action involving all the states in the area. The purpose of this compact is to create the Northeastern Resources Commission which, it is hoped, will provide such management. While studying, investigating and planning the development of water resources, the Commission will recommend changes in law or policy to promote coordination and resolution of problems. The Commission may request funds from both the signatory states and the federal government. The Commission may contract with public or private agencies to do research. The Commission may sue and be sued. The compact shall not affect any other compact into which a party state may have already entered, nor shall it discourage additional compacts. This compact shall become effective when accepted by any three of the following states: Connecticut, Massachusetts, Maine, New Hampshire, Rhode Island, or Vermont. Thereafter, any other northeastern state may become a party by enacting the compact into law. Renunciation and withdrawal by a party state must be preceded by three year's written notice of the intention to withdraw. Such notice should be sent to the governors of the party states. The provisions of the compact are severable and the invalidity of any one provision shall not affect the validity of the act as a whole. (Stewart-Fla)
W69-07602

APPROPRIATION OF WATERS; RESERVOIRS AND DAMS.

Md Ann Code, Art 96A:10-21 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Water utilization, *Water permits, *Permits, Water management (Applied), Water allocation (Policy), Consumptive use, Administrative agencies, State governments, Dams, Reservoirs, Dam construction, Reservoir construction, Obstruction to flow, Alteration of flow, Legal aspects, Legislation, Farm ponds, Appropriation.
Identifiers: Penalties, Injunctions.

In Maryland, it is unlawful for the state or any agency thereof, person, business firm, or any state political subdivision to appropriate any state waters without the written consent of the Department of Geology, Mines, and Water Resources. Such consent is not required if state water is used for domestic and farming purposes, approved municipal water supply, and non-abandoned uses in existence on January 1, 1934. A permit is required with certain exceptions concerning size from the Department for the construction or alteration of any reservoir, dam, or waterway. Farm ponds and ponds constructed as farm ponds must meet certain

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specifications in order to be exempt. Permits are also required for the construction and alteration of conduits, pipe lines, and similar devices beneath the Potomac River. Public hearings will be set on all permit applications, and limitations, concerning the date construction is to begin, and may be prescribed for granted permits. Periodic reviews of permitted uses can be conducted. Criminal penalties and injunctive powers shall serve as means of enforcement. (Wheeler-Fla)
W69-07603

FLOWAGE PETITIONS.

Conn Gen Stat Ann secs 52-446 to 52-449 (1960), as amended, (Supp 1968).

Descriptors: *Connecticut, *Mills, *Dams, *Permits, Ditches, Aqueducts, Legislation, Streams, Flow, Flow augmentation, Overflow, Damages, Easements, Obstruction to flow, Streamflow, Relative rights, Legal aspects, Local governments.

Any person who has or desires to set up a water mill upon his land may petition the superior court to improve his water power by the construction of drainage ditches, aqueducts, watercourses, or raceways if such person cannot reach an agreement with the owner of any land affected by such structures as to damages that will be paid. The petition shall contain a description of the land to be overflowed and of the structure (its location, height, and dimensions). The petition shall be heard by a committee of three disinterested property owners of the county who shall determine whether the flowing will be of public use, the structures' dimensions, the length of time during which the structure may be kept up each year, and the damages to be paid. The committee shall report its findings to the court which shall add fifty percent to the damages so assessed. The sum so computed will be paid as compensation for the right to overflow. No structure may be erected to the injury of any lawfully existing mill. Any interested person may object to the committee's report for irregularity or misconduct, but, if accepted, the report shall be final except upon the question of damages. The court may set aside the report for any reasonable cause and make its own inquiry. (Kahle-Fla)
W69-07613

HALE V HULIN (DRAINAGE).
130 So 2d 519-520 (La Ct App 1961).

Descriptors: *Louisiana, *Drainage, *Drains, Drainage practices, Surface drainage, Ditches, Water conveyance, Competing uses, Water law, Judicial decisions, Legal aspects, Surface runoff.
Identifiers: *Servitude of drain.

At issue here was plaintiff's claim to a servitude of drain, which drain consisted of a man-made ditch across a portion of defendant's property. The lower court rendered judgment for plaintiff and the third circuit court of appeals of Louisiana affirmed. The court stated the well-settled Louisiana rule that a drainage ditch is a continuous and apparent servitude and may be acquired by a possession of 10 years and that under applicable case and statutory authority it was clear that defendant's property has become burdened with a servitude of drain in favor of plaintiff's property if it is shown that the ditch has been in existence in excess of 10 years prior to the date suit was filed. The drainage ditch here had clearly been in existence for more than 10 years for which reason the court affirmed the judgment appealed from. (Carruthers-Fla)
W69-07615

SYSTEM OF COUNTY DRAINAGE.

Ga Code Ann secs 23-2501 thru 23-2573 (1966), as amended, (Supp 1968).

Descriptors: *Georgia, *Drainage districts, *Drainage systems, *Water management (Applied), Legislation, Local governments, Drainage, Right-of-way, Easements, Administration, Canals, Dams, Surface waters, Drains, Watercourses, Levees, Land reclamation, Agriculture, Tidal marshes, Legal aspects.
Identifiers: Levee districts, Agricultural lands.

Each county in the state is empowered to establish and maintain a system of lowland drainage. Necessary rights of way and easements may be acquired for that purpose. The clerk of the superior court and the board of commissioners of roads and revenue are to constitute a court having jurisdiction to establish works for the purpose of draining and reclaiming land. The drainage of swamps, the drainage of surface waters from agricultural lands and the reclamation of tidal marshes is considered a public benefit conducive to the public health, convenience, utility and welfare. The procedures to be followed by the court and the board of drainage commissioners are provided. Regulations governing the operation of the exercise of powers by the drainage district are set forth. (Childs-Fla)
W69-07616

MANNING V HALL (MUTUAL DRAINAGE SYSTEM).

110 So 2d 424-428 (Fla DCA 1959).

Descriptors: *Florida, *Drainage systems, *Drainage practices, Ditches, Drains, Reasonable use, Competing uses, Land use, Easements, Surface drainage, Judicial decisions, Arable land, Drainage water.
Identifiers: Injunctions (Permanent), easement by implication, Revocable permissive use, Mutual drain.

On appeal from a final decree granting a permanent injunction allowing plaintiffs the right to maintain a drainage ditch across defendants' lands, the Second District Court of Appeal of Florida held that the injunction was proper and affirmed the decree. The chancellor had reached his conclusion regarding injunctive relief on the basis of a finding of an easement by implication from the circumstances of a sale of land from defendant to plaintiff. The court based its holding on a finding of a mutual drain. Though reciprocal rights in such a mutual drain normally depend upon a finding of mutual contribution of expense and labor in initial construction of a drainage system, the court here held that even though plaintiff contributed no actual expense and labor, the drainage system served the land of both parties, both parties contributed mutually to its upkeep, and plaintiffs' land was dependent upon the system as a substitute for natural drainage. Hence there existed a mutual drainage system with each party having a right to the system's continued operation with such right being enforcible by injunction. (Carruthers-Fla)
W69-07619

OWNERS OF BOOMS AND BULKHEADS.

Ala Code tit 33 secs 73, 74, (11958), as amended, (Supp 1967).

Descriptors: *Alabama, *Bulkheads, *Docks, *Riparian owners, Piles (Foundations), Rates, Legislation, Structures, Boats, Riparian rights, Navigable waters, Nonnavigable waters, Adjudication procedures, Legal aspects, Regulation.
Identifiers: *Liens, *Charges, Booms.

Any riparian proprietor who has lawfully erected any boom, bulkhead, piles or other structure in front of his property may charge any person who fastens thereto $5 per day for every boat or vessel other than a flatboat, $2 per day for each flatboat, and $.05 for every pole, log, or stick of timber or wood. Such charges shall constitute liens, on such vessels or timber with process of attachment from any court having jurisdiction over the amount claimed. (Kahle-Fla)
W69-07621

GRAMMAS V COLASURDO (PRESCRIPT EASEMENT TO ENTER AND REMOVE STRUCTIONS ON SERVIENT LAND).

48 N J Super 543, 138 A 2d 553-559 (1958).

Descriptors: *New Jersey, *Prescriptive ri *Obstruction to flow, *Relative rights, Drain Ditches, Dams, Bogs, Surface waters, Easem Damages, Judicial decisions, Land tenure, Ripa land, Adjudication procedure.
Identifiers: *Charges to jury, *Trespass, Cranb bogs, Adverse use.

Plaintiff lower landowner alleged trespass by de dant upland owners in coming upon plaintiff's to clean and widen a drainage ditch pas through plaintiff's land. Defendants had for y maintained cranberry bogs on their land and drained the bogs by use of a dam gate and c over plaintiff's land. The trial judge refuse charge the jury on the theory of prescriptive ri and there was a verdict for the plaintiff. The su or court held that the issue of prescriptive ri though not formally joined, was tried by con and without objection of the parties. The court the judge should have charged the jury th prescriptive easement resulted from adverse, u terrupted, and visible use for more than 20 y The court noted that in such circumstances upper owner could remove obstructions to his e ment as long as there was no breach of the pe The lower proprietor could not complain u material damage to property could be shown. court ordered amendment of the pleadings a new trial on the issues presented. (Harris-Fla)
W69-07622

UNITED STATES V TWIN CITY POWER (VALUE OF WATER-FLOW AS PART OF C DEMNATION COSTS).

350 US 222-246 (1956).

Descriptors: *Federal jurisdiction, *Flow, *Nav ble waters, *Condemnation value, Naviga Navigable rivers, Riparian waters, Multiple- pose projects, Water policy, Legal aspects, C demnation, Compensation, Payment, River f Flow control, Flow rates, Hydraulic proper Water properties, Electric power plants, Ele power production, Hydroelectric power, W law, Judicial decisions.

The United States brought suit to condemn bordering the Savanna River Basin. The Un States is required by the Fifth Amendment to just compensation for the value of condem land. The defendant power company conten that such valuation should include the worth of land as a site for hydroelectric power operati Petition for certiorari was granted after the Fo Circuit Court of Appeals held for the defend The court observed that Congress in approving Clark Hill Project, for which this land was demned, determined that its primary purpose for improvement of navigation. Unless this C gressional policy decisions can clearly be show be an impossibility, the courts are not free to de mine otherwise, and if interests other than nav tion are served by such project, they must deemed merely incidental. Water-power i navigable river is not a private interest. Requ the government to compensate for its loss woul to create private claims in the public domain compensation for value of waterflow is allowa (Johnson-Fla)
W69-07623

WEED CONTROL IN INLAND LAKES.
Mich Comp Laws Ann secs 41.671, 41.672, 41. (1967), as amended, (Supp 1968).

Descriptors: *Michigan, *Aquatic weed cont *Financing, *Poisons, Inland waterways, Lo governments, Legislation, Conservation, Admi trative agencies, Plant populations, Plant gro regulators, Appropriation.
Identifiers: *Town limits, *Public petitions.

township board of any township may ap-
riate money from its general fund for the pur-
of controlling weeds in inland public lakes
n the township proper. Such appropriation
be upon the request by petition of 25 or more
olders within the town. Townships may com-
for the purposes of this act. Poison shall not be
to control weeds in inland lakes except with
pproval and under the supervision of the de-
ient of conservation. (Harris-Fla)
-07625

ICIPALITIES - PARTICULAR POWERS.
rimary bibliographic entry see Field 06E.
-07628

MONS V CLAYTON (OBSTRUCTION TO
W OF SURFACE WATERS).

W 2d 501-503 (Ark 1953).

riptors: *Arkansas, *Dams, *Levees, *Ob-
ion to flow, Repulsion (Legal aspects), Sur-
waters, Natural streams, Judicial decisions,
aspects, Surface drainage, Retention, Altera-
f flow, Priorities, Drainage water, Surface ru-

ifiers: Res judicata, Injunctions (Mandatory).

tiff, an owner of higher realty, sought a man-
y injunction compelling a lower owner to
ve a dam which allegedly caused flooding of a
between the tracts. In previous litigation
een the parties, the court had found that
s collected by plaintiff on his land and sub-
ntly flowing over defendant's land were only
ce waters. That determination was res judicata
s case. Thus the dam repelled only surface
and did not block a natural watercourse. The
ction was denied since under Arkansas law a
proprietor may protect himself from surface
by erecting a levee where that is the practical
od of protecting his land from surface water
where in so constructing the levee he acts in
faith and without negligence. (Kahle-Fla)
-07629

YD V CHIPPEWA COUNTY (OBSTRUC-
TO FLOW OF SURFACE WATER).

W 2d 479-486 (Wis 1954).

riptors: *Wisconsin, *Drainage ditches,
ural flow, *Obstruction to flow, *Repulsion
l aspects), Surface waters, Drainage water,
, Damages, Easements, Local governments,
ial decisions, Legal aspects, Sewers, Snow
val, Highways, Road construction.

tiffs sued Chippewa County for damages
d when water was unable to flow through a
rt under a federal highway because a county
plow had pushed snow into a county ditch
nting water from flowing into that ditch from
ate ditch on plaintiffs' land. The county had
ructed and agreed to maintain the private
in consideration for granting of an easement.
court held that the county was not liable for
h of contract since the easement agreement
nvalid as being for a private rather than a
c purpose. The county had the same common
ght as an owner of a private property to ob-
and divert the natural flow of surface water
ghway improvement or maintenance and thus
not be liable for negligence. The county, was
able under section 88.38, which provided for
construction and maintenance of drainage
es where highway construction obstructed the
al flow of surface water, since the obstructing
ay was a federal highway. Judgment was
sed, and the cause was remanded with
tions to dismiss. (Kahle-Fla)
-07630

OKER V FEIL (OBSTRUCTION TO FLOW
URFACE WATERS).
W 2d 918-920 (Iowa 1949).

Descriptors: *Iowa, *Natural flow doctrine, *Obstruction to flow, *Alteration of flow, Dams, Levees, Surface drainage, Surface waters, Judicial decisions, Legal aspects, Priorities, Damages, Maintenance, Dikes.
Identifiers: Servient land, Injunctions (Mandatory).

Plaintiffs sought damages and an injunction commanding removal of a dike constructed along the division line between two farms which prevented the natural flow of surface water. The court found that defendant's land was subservient to that of plaintiffs' and permanently enjoined the defendant from obstructing the free and complete flow of surface water. Defendant could not maintain the dike at its pre-1939 level on the theory that it had been in existence more than 10 years since a new dike, built in 1939, was a completely different dike, 12 feet south of and higher than the original dike. Plaintiffs were also awarded damages for injury to land caused by interference with the flow of surface water. (Kahle-Fla)
W69-07631

DUENOW V LINDEMAN (OBSTRUCTION TO FLOW OF SURFACE WATERS).

27 NW 2d 421-429 (Minn 1947).

Descriptors: *Minnesota, *Natural flow doctrine, *Obstruction to flow, *Ditches, Drainage, Surface drainage, Surface waters, Judicial decisions, Easements, Prescriptive rights, Natural streams, Tile drainage, Jurisdiction, Relative rights.
Identifiers: Injunctions (Prohibitory), Default judgments.

Plaintiffs sought to enjoin obstruction of a ditch on defendants' land which drained plaintiffs' upper land and to enjoin interference with plaintiffs' removal of the obstruction. Defendants, relying on their attorney's advice, inadvertently defaulted. The trial court found that plaintiffs had a prescriptive right to drain surface water into the ditch and to maintain it at a depth of five feet. On appeal, this court held the judgment void for want of jurisdiction since the question of a prescriptive right was not presented by the complaint and since the relief was in excess of that demanded. The only rights exercisable over the land by the upper and lower owners are rights to have the stream proceed across the land in its natural course. The natural right to drainage is measured according to the course of nature, while the rights under an easement are measured according to the express terms of the grant. Judgment was vacated, and defendants were granted leave to answer. (Kahle-Fla)
W69-07632

IN RE LAKE SEYMOUR (ESTABLISHMENT OF WATER LEVELS).

91 A 2d 813-818 (Vt 1952).

Descriptors: *Vermont, *Water level fluctuations, *Navigable waters, Water measurement, Water policy, Administrative decisions, Water rights, Competing uses, Prior appropriation, Public rights, Drawdown, Dams, Channel improvement, Remedies, Legislation, Lakes.
Identifiers: *Boatable water, Natural maximum level, Natural minimum level, Constitutionality.

This proceeding arose upon exceptions taken by petitioner, to the findings of fact and certificate of the Public Service Commission establishing the natural maximum and minimum levels of a lake. Petitioner owned a dam, located below the lake's outlet and had blasted out a channel that affected the natural maximum and minimum levels of the lake. Petitioner contested the findings of the Public Service Commission as not sustained by the evidence and further urged that the statute authorizing the Commission to establish the levels of the lake was unconstitutional. The court upheld the constitutionality of the statute and affirmed the findings and certificate of the Commission. The court held that since the lake was a body of 'boatable water' within the constitution, the bed of the lake is held by the people of the state in their sovereign capacity in trust for public uses, and the state must preserve the water for the common use of all. No right could be acquired by or be granted to private persons to control the water level of a boatable lake or the outflow therefrom, by artificial means for private purposes. (Carruthers-Fla)
W69-07634

BRIDGES OVER NAVIGABLE WATERS.

33 USCA secs 491-534 (1957).

Descriptors: *Bridges, *Federal government, *Legislation, *Navigable water, Bridge design, Bridge construction, Boats, Navigation, Riparian owners, Alteration of flow, Federal jurisdiction, Federal-state water rights conflicts, Water resources development, Navigable rivers.
Identifiers: Obstruction to navigation, Corps of Engineers.

Any person may construct and maintain a bridge across any navigable waters of the United States. The bridge shall not be built, however, until plans for its construction have been submitted and approved by the Secretary of the Army and the Chief of Engineers. No bridge erected or maintained under the provisions of this chapter shall at any time unreasonably obstruct the free navigation of the waters over which it is constructed. If in the opinion of the Secretary, the bridge unreasonably interferes with navigation, he shall notify the persons owning or controlling such bridges to alter it so as to render navigation possible. Whenever a complaint is made to the Secretary of the Army stating that by the placing of any bridge, piers, or abutment in the navigable waters of the United States, the current has been so deflected as to cause the caving of banks or other serious damage or danger to property, it shall be his duty to make an inquiry, and if necessary require the owners of such bridge to repair the damage. (Smith-Fla)
W69-07641

NAVIGABLE WATERS OF MARYLAND.

33 USCA secs 465 (1967), as amended, (Supp 1968).

Descriptors: *Maryland, *Navigable waters, *Dredging, *Channel improvement, United States, Legislation, Riparian rights, Relative rights, Legal aspects, Federal project policy, Navigation, Federal government, Water rights, Federal jurisdiction, Federal-state water rights conflicts, Water resources development, Navigable rivers.
Identifiers: Corp of Engineers.

When the Chief of Engineers is of the opinion dredging will improve navigation facilities, authority is granted to dredge in navigable waters within Maryland and outside the limits of projects for improvement of navigation facilities approved by Congress, regardless of United States riparian rights under Maryland law. (Harris-Fla)
W69-07642

CONSTRUCTION OF BRIDGES, DAMS, CAUSEWAYS AND DIKES.

33 USCA secs 401, 402 (1957), as amended, (Supp 1969).

Descriptors: *Legislation, *Federal government, *Navigable waters, Harbors, Bays, Navigable rivers, Navigation, Bridges, Dams, Dikes, Right-of-way, Regulation, Administrative agencies, Permits, Transportation, Mississippi, Illinois, *Canals.
Identifiers: Corps of Engineers.

It is unlawful to construct any bridge, dam, dike or causeway over or in any port, roadstead, haven, harbor, canal, navigable river or other navigable water of the United States without consent of Con-

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gress. Plans approved by Congress must be submitted and approved by the Secretary of the Army and the Corps of Engineers. However, a state may build such structures across navigable waters located entirely within that state upon approval by the Secretary of the Army and the Corps of Engineers. It is unlawful to deviate from plans so approved. This statute is applicable to the Mississippi and Illinois Canals. Whenever the Secretary approves plans for structures across these canals, he may subject the grant to terms and conditions in the public interest. (Katz-Fla)
W69-07643

PROTECTION OF NAVIGABLE WATERS - REMOVAL OF WATER CRAFT BY THE SECRETARY OF THE ARMY.

33 USCA sec 414 (1957).

Descriptors: *Navigation, *Federal government, *Legislation, *Navigable water, Rivers, Lakes, Canals, Bays, Federal jurisdiction, Federal-state water rights conflicts, Water resources development, Navigable rivers.
Identifiers: Sunken watercraft, Obstruction to navigation, Corps of engineers.

Whenever the navigation of any river, lake, harbor, or other navigable water of the United States is obstructed or endangered by any sunken vessel, boat, or similar obstruction, if such obstruction has existed for at least 30 days, or whenever the abandonment of such obstruction can be established in less time, the sunken vessel shall be broken up, removed, or otherwise disposed of by the Secretary of the Army at his discretion without liability for any damage to the owners of the vessel. The section also provides for the giving of notice and for the soliciting of sealed proposals for the removal of the obstruction. Any money received from the sale of such obstruction, or from any contractor for its removal, shall become the property of the United States government. (Smith-Fla)
W69-07644

EXCEPTION AS TO FLOATING LOOSE TIMBER, SACK RAFTS, ETC; VIOLATION OF REGULATIONS; PENALTY.

33 USCA sec 410 (1957), as amended, (Supp 1969).

Descriptors: *Legislation, *Federal government, *Navigable rivers, Streams, Transportation, *Rafts, Regulation, Water law, Navigation.
Identifiers: Corps of Engineers.

The prohibition against floating loose timber and logs in navigable streams and channels in the form of sack rafts shall not apply where use of sack rafts constitutes the principal method of navigation on a particular stream. However, the Secretary of the Army shall have the power to prescribe rules and regulations governing the use of sack rafts. The regulations shall be so framed as to equitably adjust conflicting interests between different methods of navigation on such streams. These regulations shall be published in such a manner as to give the best notice practicable to all affected parties. A violation of these regulations is punishable by a fine of not greater than $2,500 and/or imprisonment of not more than one year. (Katz-Fla)
W69-07645

RIVER AND HARBOR IMPROVEMENTS.

33 USCA secs 540, 541, 542, 545, 546 (1957), as amended, (Supp 1969).

Descriptors: *Federal government, *Rivers, *Harbors, *Administrative agencies, United States, Legislation, Navigation, Navigable waters, Shore protection, Shores, Erosion, Accretion, Channels, Project planning, Financing, Administration, Project feasibility, Federal project policy, Engineers estimates, Cost-benefit analysis, Boats, Industrial water, Hydroelectric power, Surveys, Measurement, Investigations, Data collections.
Identifiers: *Board of Engineers for Rivers and Harbors, Water terminals, Commerce, Chief of Engineers, U S Army.

Federal investigations and improvements of rivers, harbors, and waterways shall be under the jurisdiction of the Department of the Army. A Board of Engineers for Rivers and Harbors shall be organized and report to the United States on the desirability and cost of improvements to benefit commerce. 'Commerce' shall include use of waterways by all watercraft. The specified operations of the board shall be financed from appropriations by Congress. All reports on examinations and surveys authorized by law shall be reviewed by the Board of Engineers, and a report submitted to the Chief of Engineers so provided in this act. A preliminary examination and report of any proposed improvement shall be made as to its advisability. Every report shall contain, in addition to information concerning prospective commercial benefit, applicable data on existence and establishment of terminal and transfer facilities, development and utilization of water power for industrial and commercial purposes, and other subjects bearing upon improvements to navigation. Surveys of navigable waters shall include stream flow measurements, watershed data affecting navigation, information on shoreline configuration and the effect of erosion and/or accretion where applicable. (Harris-Fla)
W69-07661

RIVER AND HARBOR IMPROVEMENTS - RIGHTS OF WAY, PRIVATE IMPROVEMENT, INTERSTATE COMPACTS AND THE POTOMAC DRAINAGE BASIN.

33 USCA secs 558c, 565-567b (1957).

Descriptors: *Right-of-way, *Interstate compacts, *Federal government, *Legislation, Navigation, Harbors, Flood control, Piers, Bridges, Tennessee Valley Authority, New Jersey, Pollution control, State jurisdiction, Federal jurisdiction, Navigable waters, Federal - state water rights conflicts, Water resources development, Navigable rivers, Cities, Roads.
Identifiers: Corps of Engineers, Secretary of the Army.

The Secretary of the Army is authorized to grant easements for rights of way for public roads and streets on lands acquired by the United States for river and harbor and flood control improvements. Any person or corporation, municipal or private, who desires to improve any navigable river at their own expense and risk may do so upon the approval of the plans by the Secretary of the Army and the Chief of Engineers. Authority is given to the State of New Jersey to improve the channels on the New Jersey seacoast or the waters adjacent thereto. Plans for such improvements must be approved by the Chief of Engineers. Authority is also given to Maryland, West Virginia, Virginia, Pennsylvania and the District of Columbia to enter into an agreement to create the Potomac Valley Conservancy District and to establish an Interstate Commission on the Potomac River Basin. Authority is also given to Maine, New York, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, Pennsylvania, West Virginia, Kentucky, Indiana, Illinois, Tennessee and Ohio to enter into agreements for conserving and regulating the flow, lessening flood damage, removing sources of pollution, or making other public improvements on any rivers or streams whose drainage basins lie within any two or more of the above states. (Smith-Fla)
W69-07662

ACQUISITION OF LAND AND MATERIALS, REGULATION OF RESERVOIRS ON MISSISSIPPI.

33 USCA secs 591, 594, 601 (1957).

Descriptors: *Condemnation, *Mississippi Riv *Federal government, *Legislation, Land, Rig of-way, Easements, Reservoirs, Headwat Federal jurisdiction, Navigable water, Federal-st water rights conflicts, Water resources devel ment, Navigable rivers.
Identifiers: Secretary of the Army.

The Secretary of the Army may instit proceedings for the acquirement by condemnat of any land, right-of-way or material needed maintain, operate or construct works for the provement of rivers and harbors. After proceedings are instituted the Secretary shall h the right to take immediate possession of such p perty, to the extent of interest to be acquired, proceed with such public works as have b authorized by Congress. The Secretary sh prescribe such rules and regulations, with resp to the use and administration of the reservoirs the headwaters of the Mississippi River, as in judgment the public interest may require. S rules and regulations shall be posted in some c spicuous place for the information of the pub (Smith-Fla)
W69-07663

COWAN V BAKER (LANDFILLS).

87 So 2d 74-77 (Miss 1956).

Descriptors: *Mississippi, *Landfills, *Relat rights, *Obstruction to flow, Deflection, Fl Water levels, Flow control, Surface run Precipitation excess, Streamflow, Alteration flow, Natural flow doctrine, Reasonable use, Di sion structures, Damages, Diversion.
Identifiers: Injunctions (Mandatory).

The Mississippi Supreme Court affirmed on app a chancellor's decree awarding damages and junctive relief against a lower lot owner for di sion of surface waters onto complainant's adjoin higher lot as a result of dirt fill construction by fendant lot owner. Defendant argued before chancellor that the alleged damage to plaint fence and flower beds was not caused by any ac defendant but by floodwaters escaping from small creeks. But the chancellor found that s damage over and above what would have occur had the fill not been on defendant's lot. Thus, of the damage was a result of surface w drainage, rather than floodwater. The court firmed this finding based upon the rule that w adjoining lots owned by different persons are different level, so that there will be a natural flo rainwater from a higher to a lower level, the ow of the lower lot may fend the water therefrom, vided he does so for proper objects and exerc reasonable care to prevent unnecessary injury higher lot. (Carruthers-Fla)
W69-07664

DITCHES, MARSHES, MEADOWS A SWAMPS.

Me Rev Stat Ann tit 30, ch 217 (1965).

Descriptors: *Maine, *Wetlands, *Drain *Marshes, Salt marshes, Swamps, Fresh w marshes, Flooding, Land reclamation, Sur drainage, Ditches, Drainage programs, M management, Beaches, Grasslands, Adjudica procedure, Boundaries (Property), Financ Legislation, Water resources development, L tenure, Maintenance, Repairing, Assessments.
Identifiers: Fence-viewers.

Procedures for draining and improving meadow, swamp, marsh, beach or other low held by several proprietors are given. There provisions for application to the proper court, pointment of commissioners to determine ne notice to interested persons, and assessment collection of expenses for improvements mad land. There are provisions for maintenance repair of improvements made either by applica to court or by agreement among the parties. Ne-

xpenses for repair may be assessed and col-
. There are provisions for appeal from the or-
f the commissioners. Digging and maintain-
tches between salt marsh land under improve-
may be determined by agreement between
wners or by order of fence-viewers of any
(Helwig-Fla)
07666

**IORITY AND DUTIES OF COMM'RS PER-
ING TO DITCHES, MARSHES,
DOWS AND SWAMPS.**

ev Stat Ann tit 30, secs 3251-3262 (1965).

iptors: *Maine, *Wetlands, *Drainage,
shes, Rivers, Streams, Flooding, Surface
ge, Legislation, Water resources develop-
Local governments, Dams, Dikes, Costs,
Land tenure, Assessments.

it becomes necessary to drain or flow any
nd held by several proprietors, they may
by complaint to the superior court in the
y setting forth the proposed improvements.
ourt shall cause notice to be given to any in-
ed owners not joined. If upon hearing it ap-
the improvements will be for the general ad-
ge, the court may appoint 3 commissioners to
the improvements. They shall cause such
to be done as seems most beneficial. The ex-
of the improvements shall be apportioned
the several proprietors. Moneys assessed
be collected in the same manner as town
Upon completion the commissioners shall
a return to the court including an account of
neys collected. Expenses shall be appor-
between any life tenant and landlord. The
issioners may enter upon, drain or flood land
by one not a party to the proceedings and
mage thus done shall be paid out of moneys
ed from the parties. (Helwig-Fla)
)7667

TS OF WETLAND PROPRIETORS.
ev Stat Ann tit 30, secs 3301-3312 (1965).

ptors: *Maine, *Wetlands, *Drainage,
, Dikes, Maintenance, Repairing, Main-
e costs, Construction costs, Land tenure,
s, Drainage programs, Marsh management,
ication procedure, Boundaries (Property),
ing, Assessments, Legislation.

mprovements have been made as provided in
apter, repairs may be made to such in the
nanner after complaint to the court. In addi-
ie proprietors of any lowland so improved
old regular meetings to make rules for the
nance of such improvements. The possessor
tgaged property shall be considered proprie-
reof. Any 3 or more proprietors may apply
justice of the peace to have a meeting called.
tice shall be given all proprietors. Proprie-
all have one vote per acre owned and may
proxy. Necessary officers may be elected
orn in at such meeting and the manner of
future meetings determined. A record of
hip and transfer shall be kept. Committees
chosen to determine necessary repair to im-
ents. Expenses of repairs shall be assessed
each proprietor according to his interest. If
oprietor declines to cultivate, use or take
rom his portion of land he shall not be liable
air expenses nor entitled to vote. The as-
n may be discontinued by 2/3 vote at a
called for such purpose. (Helwig-Fla)
7668

**LS FROM ACTION OF THE COMMIS-
RS CONCERNING DRAINAGE OF WET-**
Stat Ann tit 30, secs 3351-3354 (1965).

tors: *Maine, *Wetlands, *Drainage, *Ju-
ecisions, Swamps, Marshes, Flooding, Adju-
dication procedure, Surface drainage, Ditches, Grasslands, Legislation, Land tenure, Drainage programs, Local governments.

Any person aggrieved by the commissioners' actions concerning drainage may appeal to the court within 60 days after the return is made. The court may affirm, reverse or alter any order of the commissioners. All questions of fact may, upon motion, be tried by a jury. The commissioners before opening any floodgates or making any other passage of water or erecting any structure on the land of one not a party to the proceedings, shall give him seasonable notice of their intention. The owner may appeal such action to the court. The commissioners, upon notice of appeal, shall suspend all proceedings upon appellant's land pending outcome of the appeal. An appeal may be taken to the law court. (Helwig-Fla)
W69-07669

JURISDICTION OF FENCE-VIEWERS.
Me Rev Stat Ann tit 30, secs 3401-3403 (1965).

Descriptors: *Maine, *Wetlands, *Drainage, *Salt marshes, Ditches, Marshes, Swamps, Flooding, Drainage programs, Marsh management, Beaches, Surface drainage, Legislation, Land tenure, Repairing.
Identifiers: *Fence-viewers.

The owners or occupants of salt marsh enclosed by ditches shall maintain such ditches between their own and adjoining enclosures while improving them. Such maintenance shall be in proportion to the benefits accruing to each by such improvements as determined by the fence-viewers in such town. The fence-viewers shall have jurisdiction thereof as they do over fences. Such fence-viewer shall determine the width and depth of the ditch and the time allowed for making it. If a proprietor neglects to make repairs to his portion of the ditch, it may be done by the complainant and 2 or more fence-viewers shall make a certificate of its value. The delinquent owner shall be assessed for expenses. If any person lay his land common, determines not to improve any part of his land adjoining such ditch and gives 6 months notice to all occupants of adjoining lands, he shall not be required to maintain such ditch while his lands be common and unimproved. (Helwig-Fla)
W69-07670

COMPREHENSIVE HARBOR IMPROVEMENT ACT.

N J Stat Ann secs 40:179-1 to 40:179-77 (1967).

Descriptors: *New Jersey, *Harbors, *Port authorities, *Docks, Piers, Marsh management, Riparian land, State governments, Cities, Legislation, Real property, Construction, Maintenance, Leases, Legal aspects, Financing, Regulation, Navigable waters, Easements, Right-of-way.

This article sets forth a detailed exposition of the power of cities and harbor boards to acquire land for and to construct, maintain, and lease wharves and related industrial terminals and structures in the navigable waters adjacent to such cities. All grants of riparian and underground lands must be negotiated under the auspices of the state riparian commission. Various sections enumerate detailed bond issuing functions and requirements to be followed by the various harbor boards. The article also specifies referendum procedures to be followed under various bonding ventures. (Blunt-Fla)
W69-07671

COMPREHENSIVE HARBOR IMPROVEMENT ACT.
N J Stat Ann secs 40:179-1 to 40:179-11 (1967).

Descriptors: *New Jersey, *Harbors, *Leases, *Riparian land, Docks, Piers, State governments, Cities, Legislation, Real property, Right-of-way, Easements, Compensation, Legal aspects, Safety, Regulation, Navigable waters.

Cities have the right to build and maintain docks or wharves and collect fees for their use by the public provided the city first pays the state reasonable compensation for the riparian grant or lease of the underwater lands. Cities which have acquired leases for public streets terminating in navigable waters previous to the passage of section 40:179-1 need not pay the state additional compensation before wharf construction. The mayor of any city may appoint city harbor boards. If appointed, such harbor boards shall have charge of all waterfront property belonging to the city and of all riparian rights and lands underwater, including easements and rights of way. Harbor boards are empowered to promulgate regulations for the removal of harbor obstructions and to accomplish all other acts required to make the harbors safe for commerce. The harbor boards have the power to lease all city-owned waterfront property and structures under the standards set forth in the section. (Blunt-Fla)
W69-07672

COMPREHENSIVE HARBOR IMPROVEMENT ACT.
N J Stat Ann secs 40:179-12 to 40:179-77 (1967).

Descriptors: *New Jersey, *Riparian land, *Condemnation, *Financing, Local governments, Cities, State governments, Administrative agencies, Regulation, Government finance, Planning, Legal aspects, Construction, Navigable waters.

Harbor boards may recommend that the city government acquire additional upland, riparian land, or underwater land by purchase or condemnation. The boards may recommend that the cities secure additional grants of riparian or underwater lands from the state. The boards shall have the power to issue 'harbor improvement bonds.' This act does not affect the state's rights in any riparian lands or the jurisdiction of the state riparian commission over them. Detailed harbor bond procedures are set forth. Cities may issue bonds for the construction of industrial terminals on water front lands now owned or to be acquired by the cities. Bond issues, referenda requirements, and other fiscal matters are dealt with. Sections 40:179-68 to 40:179-77 deal with the reclamation of marshlands acquired by cities under the general provisions of this harbor improvement act. (Blunt-Fla)
W69-07673

SCHATZ V GUTHRIE (RIGHT TO NAVIGATE A TRIBUTARY).
132 NYS 2d 665-670 (N Y Sup Ct 1954).

Descriptors: *New York, *Navigable waters, *Riparian rights, *Easements, Right-of-way, Streams, Permits, Docks, Remedies, Judicial decisions, Legal aspects, Navigation, Public rights, Access routes, Tributaries, Barriers.
Identifiers: Injunctions (Prohibitory).

Plaintiffs' land lay directly north of a tributary of a navigable stream. Defendants, owners of the bed under the tributary, moved a large barge immediately south of plaintiffs' land so as to interfer with plaintiffs' use of the tributary. Plaintiffs brought this action seeking to restrain interference with their free access to the tributary. The court granted the injunction. It found from the evidence that plaintiffs were upland owners who enjoyed riparian rights and all the easements that flowed therefrom. By positioning their barge as they had, defendants improperly and unlawfully interfered with plaintiffs' right of access and their right to construct landing wharves and piers. The court indicated that the title to land under a navigable stream tributary is subject and subservient to the upland owners right of access to the navigable portion of the stream as well as their right to erect structures to enable them to reach such portion of the stream. The court also found that defendants'

LIBRARY U. OF I., URBANA-CHAMPAIGN

actions had interfered with the public's right to navigate the tributary. (Gabrielson-Fla)
W69-07677

DOIRON V O'BRYAN (MEANING OF RIPARIAN RIGHTS IN A CONVEYANCE).

218 La 1069, 51 So 2d 628-634 (1951).

Descriptors: *Louisiana, *Riparian rights, *Alluvium, *Land tenure, Lake shores, Lake beds, Water law, Judicial decisions, Legal aspects, Dredging, Ownership of beds, Landfills, Rivers, Riparian land, Lakes, Remedies, Land forming, Land development.
Identifiers: *Riparian land conveyances, Jactitation.

Plaintiff brought this action in jactitation against defendant to determine ownership of a parcel of land adjacent to a lake. Because of erosion, for many years this land had been submerged, but due to dredging it became highland. Defendant based his claim on a conveyance from plaintiff by which the deed described the property conveyed as including all lands to the shore of the lake together with all riparian rights belonging to the vendor therein. Plaintiff claimed that defendant was only entitled to the highland existing at the time of conveyance. The court, in holding in favor of defendant found plaintiff entitled to both the highland and the submerged land. The court felt that a conveyance of all land to the shore including riparian rights constituted more than just the riparian use of the water. Such a conveyance included whatever right of ownership, however acquired, the grantor had to the bed of the lake which was covered by water. The court stated that the rights of alluvion and dereliction were not applicable to riparian owners adjacent to a lake, but that plaintiff had acquiesced to defendant's ownership to the property in question. (Holt-Fla)
W69-07678

USE AND DISPOSITION OF WATER.

N J Stat Ann secs 58:22-9, 58:22-12 to 58:22-16 (1966).

Descriptors: *New Jersey, *Water works, *Reservoirs, *Water management (Applied), Public utilities, Storage, Legislation, Eminent domain, Recreation, Streamflow, River basins, Federal government, Municipal water, Rivers, Conservation, Planning, Water rates, Gaging stations, Administrative regulation, Riparian rights, Water supply, Condemnation.

Whenever the flow of water in the Raritan River is less than the rates specified as acceptable at different gauging stations, a sufficient amount of water shall be released from Spruce Run Reservoir to make up the deficiency. The Department of Conservation shall have jurisdiction and control over water made available pursuant to this act. This control includes the power to sell to persons, corporations, and municipalities, after public hearing, and to set reasonable rates. The department shall have power to determine existing water rights in riparian owners, to acquire land necessary for a water supply facility, to receive federal aid for the construction of water supply facilities, to receive other aid or contributions, to adopt regulations for control of facilities, and to enter land to make surveys or examinations. Whenever land is taken by eminent domain proceedings the department may file with the superior court a declaration of taking setting forth a description of the property, the estate or interest being taken, and the sum estimated as just compensation, which sum shall be deposited with the court until a final determination is had. The department shall also have power to make reasonable regulations for the relocation and removal of facilities. The public utility operating the facility before relocation may continue to operate the new facility under the same terms as originally agreed. Any county, municipality, or political subdivision may sell, lease or lend land to the department for a facility. Reservoirs created pursuant to this act may be used for public recreation. (Kahle-Fla)
W69-07681

AN ACT FOR THE ESTABLISHMENT OF AN INTERIM COMM'N ON THE UPPER MISSISSIPPI RESERVOIRS.
Minn Sess Laws ch 862 (1957).

Descriptors: *Minnesota, *Water resources development, *Reservoirs, *Water pollution control, Water quality control, Water conservation, Rivers, Streams, Legal aspects, Lakes, State governments, Planning, Water policy, Water control, Legislation, Sewage districts, Mississippi River.
Identifiers: Commissions (Interim).

Minnesota created an interim commission for the proper control and regulation of the reservoirs at and near the head waters of the Mississippi River. The commission, consisting of appointed members of the state legislature, was authorized and directed to study the legal factors involved, to recommend legislation found by it to be desirable, and to contact and secure the cooperation of Minnesota members in Congress and federal agencies exercising control. The commission was to report to the governor and to the 1959 session of the Legislature. An interim commission was also created to study the problem of water pollution of state waters, to consider the feasibility of establishing sanitation districts where needed, and to recommend any and all reasonable means of effectively controlling the problems. The commission was to consist of members appointed from the Legislature, and was to report to the Legislature in 1959. (Wheeler-Fla)
W69-07682

SUSQUEHANNA RIVER BASIN COMM'N, ARTS 6, 7 and 8 (FLOOD PROTECTION, WATERSHED MANAGEMENT AND RECREATION).

Md Ann Code, Art 96A:65-67 (Supp 1968).

Descriptors: *Maryland, *River basin commissions, *Flood control, *Watersheds (Basins), Recreation, Watershed management, Basins, Drainage, River basins, Interstate commissions, Interstate compacts, Soil conservation, Forest management, Wildlife conservation, Flood plains, Eminent domain, Flooding, River systems, Multiple-purpose projects, Legislation, Regulation, Flood damage, Planning, Recreation facilities.
Identifiers: *Susquehanna River Basin Comm'n, Police power, Flood plain development, Use standards.

The Susquehanna River Basin Commission may plan, operate and maintain projects for flood plain development and flood damage reduction. After study of the flood plains, the Commission may delineate areas subject to flooding and establish use standards thereof. The Commission shall consider the welfare of the persons and land in the effected areas in setting the standards and may regulate the flood plains only with the consent of the effected signatory states. The Commission shall have the power of eminent domain in carrying out its purposes. The Commission shall promote sound watershed management practices in the basin. It shall encourage soil conservation, forest management, wildlife management and shall cooperate with the signatory states in affecting these ends. The Commission may provide for the development of recreational facilities, cooperating with the signatory states in the planning and effectuating of a program of recreation within the basin. (Helwig-Fla)
W69-07683

SUSQUEHANNA RIVER BASIN COM ARTS 9, 10, 11 and 12 (PUBLIC VA HYDROELECTRIC POWER, DIVERSIONS INTERGOVERNMENTAL RELATIONS).

Md Ann Code, art 96A:68-71 (Supp 1968).

Descriptors: *Maryland, *River basins, *Inte compacts, *Hydroelectric power, *Diversio teragency cooperation, Conservation, Int commissions, Rivers, Basins, Local goverr State governments, Taxes, Natural reso Scenery, History, Dams, Hydroelectric Public utilities, Withdrawal, Permits, shortage, Cost sharing, Administrative ag Regulation, River basin development.
Identifiers: Public values, Susquehanna River Comm'n.

The Susquehanna River Basin Commission i sidering, developing and constructing all p under its authority, shall preserve historic, and natural values in the basin. It may adopt tions which will protect local communities Commission may use or authorize the use river for the generation of hydroelectric pow may develop facilities for the generation and mission of such power. It shall not engage business of direct sale of power to consum may enter into contracts with public agenc generation and sale of hydroelectric powe Commission may regulate withdrawal and sion of surface and ground waters from the b shall delineate areas of water shortage or em cy and regulate withdrawal accordingly by a system. Federal, state and local agencies an jects in the basin shall be subject to and go by established regulations. The taxing po signatory states is preserved. The Commissio develop an equitable cost sharing plan for th projects. The Commission shall cooperate w signatory states in effectuating the purposes compact. (Helwig-Fla)
W69-07684

SUSQUEHANNA RIVER BASIN COMM'N 14 (PLAN, PROGRAM AND BUDGETS).

Md Ann Code, Art 96A:73 (Supp 1968).

Descriptors: *Maryland, *River basins, basin comm'ns, *Interstate compacts, Wate (Basins), River systems, Basins, Interstate Water law, Interstate comm'ns, Capital Capital, Budgeting, Administration, Pr Planning, Programs, Cost sharing, Fin Legislation, River basin development, resources.
Identifiers: *Susquehanna River Basin Comm

The Susquehanna River Basin Commissio develop and adopt immediate and long-rang for river basin development. In the developr a plan, the Commission shall give due re recommendations of the private and public It shall hold public hearings on all matters w considers will materially affect the basin resources. The Commission shall annually s water resources program based on the comp sive plan. The program shall include: resources needs; projects to satisfy the need statement of proposed projects. The Comm shall annually adopt a current expense bud a capital budget, including all proposed capi jects. (Helwig-Fla)
W69-07685

CONTRACTS FOR INTERSTATE BRI REPORT TO GOVERNOR; DIVERSIO NONNAVIGABLE STREAM.

W Va Code Ann secs 17-4-34, 17-4-35 (196

Descriptors: *West Virginia, *Legislation governments, Bridges, Bridge constructi terstate, Administrative agencies, Roads construction, Non-navigable waters, S Eminent domain, Diversion, Alteration of fl

it is necessary to connect a state road with a highway of an adjoining state, the state road issioner, with the approval of the governor, y filing with the governor a written report, is rized to contract with proper authorities in ljoining state for the joint purchase, erection naintenance of a bridge across the stream ating the two states. The state road commis-, incidental to the construction and main-ce of state roads, shall have the power and rity to change or divert any stream of water is not navigable, in order to avoid or ate the crossing thereof, or to economize in nstruction or maintenance of any such road, protect the same from damage. To effect a e or diversion of any such stream, he may ex- the right of eminent domain. (Carruthers-

07686

TETION AND IMPROVEMENTS TO LAND AVIGABLE WATER.
nn Code art 54, secs 45, 46-48 (1966).

iptors: *Delaware, *Navigable waters, etion (Legal aspects), *Riparian rights, Bank n, Navigable rivers, Ownership of beds, River Oysters, Piers, Riparian waters, Streambeds, , Streams, Navigation, Patents, Legal s, Legislation, Nonnavigable water, Beds.

roprietor of land bounding on any navigable shall be entitled to all accretions from natural er causes to the same extent that such right e claimed by the proprietor of land bounding nnavigable water. Any such proprietor shall titled to the exclusive right of making im-ments into the bordering waters. Such im-ments or accretions shall pass with the land to sive owners. No improvement shall interfere avigation on any stream. On or after June 1, a riparian owner may erect a pier, or other ure on his property without incurring liability mage to any oyster bed leased on or after that No patent hereafter issued out of the land of-hall impair the rights of riparian owners as ed herein. No patent shall hereafter issue for overed by navigable waters. (Helwig-Fla)
07693

Groundwater Management

AL REPORT ON GROUNDWATER IN ONA SPRING 1966 TO SPRING 1967,
ox.
State Land Dept., Water-Resources Rept. No ay, 1968. 44 p, 30 fig, 1 tab.

ptors: *Arizona, *Water consumption, ndwater basins, Arid lands, Aquifer charac-s, Withdrawal, Recharge, Water table, Un-und storage, Water levels, Irrigated land.

2/3 of Arizona's water supply is withdrawn roundwater reservoirs, mainly for irrigation. port includes graphs showing water levels in d wells and estimated annual groundwater ge in most of Arizona. The maps show (1) to water, (2) change in water level, and (3) ial well production. A summary of current lwater programs and publications dealing rizona is presented. Arizona is divided into 3 provinces. The Basin and Range Lowlands ce, of the south, is the best developed turally and is subject to a rapid decline of level. The plateau Uplands province, north, xtensive irrigated crops and suffers no large level decline. Groundwater withdrawal is nd water-level declines are slight in the Cen-ghlands province. Reduced annual ground-pumpage for 1965 and 1966 over previous is attributed to the planting of crops that less water, more precipitation and in-d amounts of surface water runoff. (Sher-Ariz)
7337

GROUNDWATER CONDITIONS IN THE WATERMAN WASH AREA, MARICOPA AND PINAL COUNTIES, ARIZONA,
E. E. Denis.
Arizona State Land Dept, Water-Resources Report, No 37, August, 1968. 23 p, 9 fig, 3 tab.

Descriptors: *Water levels, *Water consumption, *Arizona, Groundwater, Salinity, Fluorides, Sodium, Basins, Aquifer characteristics, Arid lands, Withdrawal, Drawdown, Hydrologic data, Irrigation water, Wells, Pumping, Water quality.
Identifiers: Waterman Wash (Ariz).

This report describes groundwater conditions and water level trends in an arid Arizona basin subjected to year round crop production and recent expansion of cultivated acreage from 3,500 acres in 1952 to 19,000 acres in 1965. Most of the groundwater, in sand and gravel alluvial fill, is under water table conditions. Water level declines for 1961-66 ranged from 20 to 40 ft. Fluoride concentrations in 90% of the samples is high enough to cause rejection for public water supplies. Sodium and salinity hazard is classed as high to very high. Tailwater recirculation practices will slow down, but not stop the depletion at 260,000 acre ft/yr of the 9,240,000 acre ft (1965) supply. (Sherbrooke-Ariz)
W69-07338

THE CHANGING ROLE OF THE GROUNDWATER RESERVOIR IN ARID LANDS,
Bureau of Reclamation, Phoenix, Ariz. Geology Div.
E. E. Komie.
International Conference on Arid Lands in a Changing World, Arizona University, Tucson, June 3-13, 1969. 5 p.

Descriptors: *Groundwater, *Water resources planning, *Arid lands, Groundwater mining, Safe yield, Aquifers, Land subsidence, Overdraft, Underground storage, Competing uses, Water users, Reasonable use, Water conservation, Impaired water quality, Water resources planning, Future planning (Projected).
Identifiers: Western United States.

Groundwater reservoirs have historically sustained much of the growth of agriculture in the Western United States. Uncoordinated groundwater development in the arid areas has resulted in extensive groundwater mining. This overexploitation has caused land subsidence and degradation of water quality. Many present large scale surface water importation projects result from declining water levels in areas where the establishment of agriculture was through the depletion of groundwater storage. Factors influencing the changing role of groundwater reservoirs are: (1) non-agricultural uses increasing faster than agricultural ones, (2) municipal and industrial water requirements displacing the same land areas previously devoted to irrigated agriculture, (3) water that was previously required for agriculture is usually more than ample to provide for this changing use, and (4) this transition of use makes more water available for reuse at localized points and with more convenience than would be associated with return flow from irrigation. These changing conditions require that groundwater reservoirs now must assume diverse functions beyond simple exploitation and become part of a total water resource system. Total water resource system planning, with the use of computer-oriented techniques, will assume new importance in the arid lands of the Western United States. (Sherbrooke-Ariz)
W69-07351

A RECONNAISSANCE OF THE GROUNDWATER GEOLOGY OF MONTVILLE TOWNSHIP, MEDINA COUNTY, OHIO,
Kent State Univ., Ohio. Dept. of Geology.
Raymond E. Zacuzzo.
The Compass of Sigma Gamma Epsilon, Vol 46, No 4, pp 207-216, May 1969. 10 p, 6 fig, 1 tab, 4 ref.

Descriptors: *Aquifers, *Geology, *Water resources, *Ohio, Glacial drift, Shales, Water yield, Wells, River basins, Specific capacity, Drawdown, Salinity, Chlorides, Sediments, Chemical analysis, Statigraphy, Economics, Permeability, Topography.
Identifiers: Medina County (Ohio), Ground-water geology.

Groundwater resources of Montville township, Ohio were investigated on the basis of topographical, geological, and hydrological data. The study shows that near-the-surface rocks consist of glacial deposits and sedimentary bedrock which contains some potable water. The bedrock, mostly consisting of shale, yields from 1 to 50 gpm to small-diameter domestic wells. Higher yields are obtained from the wells located along the walls of the major valley. It is believed that the yields can only be increased slightly by deepening the wells beyond 100-foot depths. Several wells of the township are contaminated with saline water which in places reaches a concentration of 150 ppm of chloride. (Gabriel-USGS)
W69-07492

HYDROLOGIC RESPONSE TO IRRIGATION PUMPING IN HUALAPAI FLAT, WASHOE, PERSHING, AND HUMBOLDT COUNTIES, NEVADA, 1960-67,
Geological Survey, Carson City, Nev.
James R. Harrill, and P. L. Soule.
Nev Water Resources Bull No 37, 1969. 75 p, 10 fig, 1 plate, 21 tab, 32 ref.

Descriptors: *Groundwater, *Water level fluctuations, *Water yield, *Aquifers, *Nevada, Water levels, Transmissivity, Safe yield, Hydrographs, Groundwater basins, Water resources development, Irrigation water, Water quality.
Identifiers: Hualapai Flat (Nev), Washoe County, Pershing County, Humboldt County.

A survey report of the water supply of Hualapai Flat, Nevada describes the groundwater flow system under near natural conditions. Estimated recharge and discharge are on the order of 5,000 acre-ft/yr. Estimated perennial yield is 6,700 acre-ft. All groundwater development is in the northern half of the area. Pumping during the period spring 1960 to spring 1967 has resulted in an estimated storage depletion of 22,000 acre-ft. Net pumpage during the 1967 irrigation season was estimated to be 7,400 acre-ft, which exceeds the estimated perennial yield by about 10%. Pumping is both localized and asymmetrically distributed with respect to natural discharge; consequently, a large quantity of water must be withdrawn from storage before the perennial yield can be salvaged. Before all natural discharge in the valley can be salvaged by pumping, levels at the northern end of the development may decline 150 ft or more. Transmissibility values range from less than 50,000 to more than 100,000 gpd/ft. The long-term storage coefficient for the entire area may average 12 to 13%, but locally may be as high as 20%. Chemical quality of the water in 1967 was generally satisfactory for irrigation, domestic, and stock use, except in the vicinity of the playa. Over the long term, recycling of pumped water and the possibility of migration of poor quality water from beneath the playa could result in a gradual deterioration in water quality in areas of use. (Knapp-USGS)
W69-07501

GEOHYDROLOGY AND WATER UTILIZATION IN THE WILLCOX BASIN, GRAHAM AND COCHISE COUNTIES, ARIZONA,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02F.
W69-07506

WATER RESOURCES OF THE BIG OTTER CREEK DRAINAGE BASIN,
Water Resources Commission (Ontario).
For primary bibliographic entry see Field 03B.
W69-07508

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REGIONAL HYDROGEOLOGY OF THE NAVAJO AND HOPI INDIAN RESERVATIONS, ARIZONA, NEW MEXICO, AND UTAH,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02F.
W69-07512

WATER RESOURCES OF THE BUFFALO RIVER WATERSHED, WEST-CENTRAL MINNESOTA,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 03B.
W69-07513

WATER RESOURCES OF THE OTTER TAIL RIVER WATERSHED WEST-CENTRAL MINNESOTA,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 03B.
W69-07514

GENERAL SYSTEMS APPROACH TO GROUNDWATER PROBLEMS,
Arizona Univ., Tucson.
Lucien Duckstein, and Chester C. Kisiel.
Proc, Nat Symp Anal Water-Resource Syst, pp 100-115, Denver, July 1968. 16 p, 60 ref.

Descriptors: *Systems analysis, *Groundwater, *Optimization, *Decision making, *Water management (Applied), Water policy, Input-output analysis, Leontief models, Regional analysis, Social aspects, Water supply, Surface-groundwater relationships, Constraints.
Identifiers: Descriptive models, Optimizing models.

A survey of the state of the art in groundwater systems analysis, with extensions, was presented. Four levels of groundwater systems problems were discussed: optimal design of devices, intra-basin design and operation, basin-wide policy, and regional community goals. It was stated that the four levels constitute a multilevel optimization problem in that decisions at higher and lower levels influence the optimal decision policy at other levels. Several specialized tools used to study the above levels were described: (a) Direct physical models, both descriptive and optimizing; (b) Input-output analysis, both 'black-box' (e.g. Leontief) and goal seeking systems and (c) the State Variable Approach, both descriptive and optimizing, used by management to observe the behavior of the system as a result of applying an input on a state. Several solved and unsolved problems were discussed. For main entry see W69-07562. (Gysi-Cornell)
W69-07567

CALIFORNIA'S DIGITAL APPROACH TO GROUNDWATER MANAGEMENT STUDIES,
California State Dept. of Water Resources, Los Angeles.
Ernest M. Weber.
Proc, Nat Symp Anal Water Resource Syst, pp 116-120, Denver, July 1968. 5 p.

Descriptors: *Digital computers, *Groundwater, *Water management (Applied), *California, Surface-groundwater relationships, Project planning, Computer models, Analog computers, Storage capacity, Transmissivity, Mathematical models, Simulation analysis, Data collections.

The development, use, acceptance by local agencies, and future needs, of digital computer studies of groundwater management problems in California was discussed. The history of California's early project staging studies, and its initial use of analog computers was given. The development of mathematical models for simulation of the groundwater system on digital computers was outlined. The evolution from the linear models of 1961 to nonlinear models of the present was described. Use of the models to obtain quantitative values for transmissivity and storage was discussed. The cooperative investigations of several local agencies with the State were listed, and the gradual acceptance of digital models over the more educationally and visually oriented analog models was noted. Future needs in the development and collection of data for use in computer simulations were given. For main entry see W69-07562. (Gysi-Cornell)
W69-07568

ON MULTILEVEL OPTIMIZATION IN GROUNDWATER SYSTEMS,
California Univ., Los Angeles.
John A. Dracup, and Yacov Y. Haimes.
Proc, Nat Symp Anal Water-Resource Syst, pp 122-125, Denver, July 1968. 4 p, 14 ref.

Descriptors: *Optimization, *Analytical techniques, *Groundwater basins, Systems analysis, Aquifers, Dynamic programming, Linear programming, Water resources development, Mathematical models.
Identifiers: *Multilevel optimization, *Decomposition, Subsystems.

The use of multilevel optimization techniques for the solution of groundwater system problems was discussed. The concept of multilevel optimization was based on the decomposition of large scale and composed systems and then the reconstruction of the system into independent subsystems. The advantages were: (1) conceptual simplification of complex systems not otherwise solvable, and (2) reduction in dimensionality of the problem. After first level optimization of the subsystems, the subsystems were tied together through coordinator parameters which were responsible for (second level) optimization of the whole system. The application of the above techniques to the California Central Valley Project, where dynamic programming was used for first level optimization and linear programming for the second, was described. Other applications of the technique, such as a two aquifer system identification model and a reverse-osmosis desalination model were briefly described. For main entry see W69-07562. (Gysi-Cornell)
W69-07570

WELLS.

Md Ann Code Art 96A, secs 30-49 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Well permits, *Well regulations, *Drilling, Legislation, Water wells, Well casings, Logging (Recording), Well screens, Water yield, Administrative agencies, Aquifers, Groundwater, Legal aspects.
Identifiers: Penalties (Criminal).

Nothing in this title shall be construed to limit the power of any municipality or state agency to adopt regulations not inconsistent with the provisions herein. No well shall be drilled until a permit has been received from the Department of Geology, Mines and Water Resources. The driller shall give such information as the Department may require. Upon completion, a report shall be filed giving the log of each well, size and depth, diameters and lengths of casing and screen, static and pumping levels, yield of the well, and any other information the Department may require. No well driller shall construct a well for any owner who is required to obtain a permit under section 11 of this article until such permit is obtained. Owners of wells shall maintain them in accordance with Department regulations. No owner shall discharge from a well water which is allowed to run to waste. The terms 'well,' 'well driller,' 'owner,' 'person,' 'underground water,' and 'acquifer' are defined. Violations of any provisions of this subtitle are deemed misdemeanors and are punishable by fine of not more than $250 for each such violation. (Kahle-Fla)
W69-07604

4C. Effects on Water of Man's Non-Water Activities

HUERTH V TOWN OF PRAIRIE DU (ROAD CONSTRUCTION OBSTRUCTING FACE WATER FLOW).
For primary bibliographic entry see Field 06E.
W69-07310

PARTICULAR CLASSES OF CORPORATI (COMPANIES FOR THE ERECTION BRIDGES OR CONSTRUCTION OF CANAL

Md Ann Code art 23, secs 141-143 (1957 amended, (Supp 1968).

Descriptors: *Maryland, *Canal construc *Bridge construction, Docks, Public ben Navigable rivers, Nonnavigable waters, Legisla Contracts, Condemnation, Local governm Compensation, Landfills, Abutments, Righ way, Roads, Bridges.
Identifiers: *Corporations, Deeds.

A corporation desiring to build a bridge may a with landowners for the lands or interests th necessary for bridge abutments, canal cons tion, roads, earth for construction, terminals, d and wharves. The rights acquired shall be conv by deed and recorded. In case of failure to a disability or absence of the owners from the the corporation may obtain the lands by demnation. When any bridge or canal structed pursuant to consent of the county com sioners as required by section 140, the corpor shall report in writing to the commissioners completion. The commissioners shall appoint persons to examine the structure to deter whether it has been durably constructed in s manner as is required to promote the public venience. No bridge shall be erected on a navi river, unless authorized by the State Roads mission. (Kahle-Fla)
W69-07614

WATER CONTRACTS.
For primary bibliographic entry see Field 06E.
W69-07626

SIDEWALKS AND PAVEMENTS.

Mich Comp Laws Ann sec 41.273 (1967 amended, (Supp 1968).

Descriptors: *Michigan, *Road constru *Drainage, *Financing, Assessments, Cul Bridges, Legislation, Paving, Drainage engine Construction costs, Legal aspects.
Identifiers: *Sidewalk drainage, *Road imp ments.

Upon proper application or resolution an proval and investigation by the county road mission, any pavement or sidewalk improv constructed shall be deemed to include all br road drains, drainage structures, curbing, cu and additional rights-of-way necessary. Th pense of such improvements shall be inclu the special assessment roll for the overall pav sidewalk. (Harris-Fla)
W69-07638

4D. Watershed Protection

SUCCESS OF WATERSHED DEVELOP IN LOCAL COMMUNITIES,
Oklahoma State Univ., Stillwater.
For primary bibliographic entry see Field 06E
W69-07392

TURAL AND MAN-MADE EROSION IN THE MID TROPICS OF AUSTRALIA, MALAYSIA D SINGAPORE,
Univ. (England). Dept. of Geography.
primary bibliographic entry see Field 02J.
-07539

SION OF GRANITE TERRAINS UNDER PICAL RAIN FOREST IN AUSTRALIA, LAYSIA AND SINGAPORE,
Univ. (England). Dept. of Geography.
primary bibliographic entry see Field 02J.
-07540

LOAD TRANSPORT AT FLOOD TIME,
la Glowna Gospodarstwa Wiejskiego, Warsaw and). Dept. of Hydraulics Engineering.
primary bibliographic entry see Field 02J.
-07541

NTITATIVE FORMULATION OF STREAM WATERSHED MORPHOLOGY,
nsylvania State Univ., University Park. Dept. of Engineering.
Shulits.
m of Surface Waters, Proc Gen Assembly of (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No p 201-208, 1967. 8 p, 35 ref.

riptors: *Bibliographies, *Reviews, *Channel phology, Hydraulics, Regime, Geomorphology, nage density, Meanders, Rivers, Streams, Ter- analysis.
tifiers: *USA, Stream morphology, Drainage morphology.

view and bibliography are presented of the ch in the last two decades for methods of quan- ve formulation of watershed and stream phology, particularly with respect to engineer- edimentation. The American effort is sampled eviewing work of the U. S. Department of culture, the U. S. Department of the Interior, the U. S. Department of the Navy. (Knapp-S)
-07546

CHARGE FREQUENCY COMPARED TO G-TERM SEDIMENT YIELDS,
cultural Research Service, Sidney, Mont. hern Plains Soil and Water Research Center.
L. Neff.
m of Surface Waters, Proc, Gen Assembly of (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No p 236-242, 1967. 7 p, 3 fig, 3 tab, 8 ref.

riptors: *Sediment yield, *Discharge (Water), sion control, Peak discharge, Bank protection, stability, Land management, River training, conservation, Stream stabilization, Water con- Watershed management.
ifiers: *Discharge frequency.

long-term sediment movement by natural ns results from flows that occur more ently than once every 10 years. However, is a direct relationship between the variability nual peak discharges and the amount of sedi- moved by less frequent flows. In arid and arid areas, which have the greatest variability nual peak flows, only 40% of the long-term ent load is moved by flows having a frequen- less than 10 yrs. In humid and sub-humid re- where there is much less variability in annual flows, over 90% of the long-term sediment ment is caused by flows that occur more ently than once every 10 yrs. This concept e used when designing sediment control ds in that the most efficient control depends the kind of flows responsible for the largest f the total sediment movement. In arid re- efficient erosion control requires proper gement of the large, infrequent flows; as in humid areas control can best be done by gement of the smaller, more frequent rges. Proper design for sediment control in natural streams must take into account not only the sediment volume involved, but also the characteristics of the hydraulic forces causing movement. (Knapp-USGS)
W69-07548

MISCELLANEOUS STATUTES (WATERSHED MANAGEMENT).

Minn Sess Laws ch 644 (1957).

Descriptors: *Minnesota, *Wildlife conservation, *Wildlife management, *Water conservation, Legislation, Drainage, Flood control, Watershed management, Lakes, Ponds, Marshes, Wetlands, Hunting, State governments, Land management, Administrative agencies, Local governments.

The commissioner is authorized to acquire wildlife lands in the name of the state. The lands subject to acquisition include marsh or wetlands and their margins, including ponds, small lakes and stream bottoms, which he finds desirable for the interests of water conservation as related to wildlife development. Purchases must be approved by the Board of County Commissioners in the county where the land is located. Soil conservation district supervisors are to counsel the Board as to the best utilization of the land to be purchased and on questions of drainage and flood control. The Commissioner in the purchase of such wetlands must not interfere with or delay drainage proceedings instituted by landowners in watershed areas when such proceedings are conducted according to the Minnesota Drainage Code. Funds for carrying out this act are to be provided by a one dollar surcharge on hunting licenses. Payments to counties in lieu of taxes on lands so acquired shall be paid from these funds. (Kahle-Fla)
W69-07591

SOIL CONSERVATION DISTRICTS TO PREVENT EROSION.
W Va Code Ann secs 19-21A-2, 19-21A-5, 19-21A-8, 19-21A-13C (1966).

Descriptors: *West Virginia, *Erosion control, *Soil conservation, *Flood control, Land use, Legislation, Crop production, Cities, Flood protection, Dikes, Storm runoff, Water supply, Bodies of water, Sedimentation, Projects, Navigation, Fish food organisms, Permeability, Soil stabilization, Recreation, Topsoil, Porosity, Soil surfaces, Drainage water, Public health.

It has been recognized by the legislature that improper land use practices have caused serious soil erosion. The preservation of farm land is essential to the health, safety, and welfare of the public. Soil erosion has caused the accumulation of silt and sedimentation in streams, reservoirs, and other bodies of water. By removing valuable topsoil, erosive forces have sharply decreased the productivity of land. In addition, the loss of the absorptive topsoil has perpetuated conditions conducive to flooding. The accumulation of silt and sediments on lake and river beds has destroyed the flood supply of fish and has interfered with navigation. To combat erosion, soil conservation districts shall be established. Any twenty-five persons owning land lying within the territorial limits of a proposed district may petition the state soil conservation committee to organize a district. Once organized, the district has power to investigate and to take preventive or improvement measures. The district shall also have numerous other comprehensive powers to allow it to deal effectively with this serious problem. Cities and counties are authorized to contract with a district for construction of flood control projects and to use the projects as recreational areas. (Stewart-Fla)
W69-07609

CONDEMNATION BY COUNTIES FOR WATERSHEDS.
Ga Code Ann secs 36-1401 through 36-1405 (Supp 1968).

Descriptors: *Georgia, *Eminent domain, *Watershed management, *Flood control, Legislation, Condemnation, Local governments, Watersheds (Basins), Small watersheds, Flood protection, Easements, Recreation facilities, Legal aspects.
Identifiers: Improvement works, Watershed projects.

In order to create small watershed projects and to provide for flood control, each county is authorized to exercise the power of eminent domain. This power is exercisable for the purpose of creating recreational facilities developed in connection with any watershed project. In addition, the power of eminent domain may be used to acquire ways of ingress and egress to any such project. The procedures to be followed in condemning land for the enumerated purposes are to conform with those provided by existing eminent domain statutes. (Childs-Fla)
W69-07618

PROTECTION OF NAVIGABLE WATERS - INVESTIGATIONS CONCERNING EROSION OF SHORES OF COASTAL AND LAKE WATERS.

33 USCA secs 426, 426-1, 426-2, 426-3, (1967) Supp.

Descriptors: *Erosion control, *Federal government, *Legislation, *Navigable water, Erosion, Coasts, State jurisdiction, Ocean currents, Beach erosion, Waves (Water), Administrative agencies, Coordination, Lakes, Lake shores, Federal-state water rights conflicts, Water resources development, Navigable rivers, Federal jurisdiction.
Identifiers: Coastal Engineering Research Center, Corps of Engineers, Secretary of the Army.

The Chief of Engineers of the United States Army, under the direction of the Secretary of the Army, is authorized to cause investigations to be made in cooperation with the appropriate agencies of the various states on the Atlantic, Pacific, and Gulf coasts, the Great Lakes, and the states of Alaska and Hawaii, the Commonwealth of Puerto Rico, and the possessions of the United States. Such investigations are made to aid in devising effective means of preventing erosion of the shores of coastal and lake waters by waves and currents. The Beach Erosion Board previously provided for is abolished by Public Law 88-172. The investigations shall be established under the Chief of Engineers, a Coastal Engineering Research Center which shall be vested with all the functions of the Beach Erosion Board including the authority to make general investigations. All functions of the Beach Erosion Board pertaining to the review of reports of investigations made concerning erosion, are transferred to the Board of Engineers for Rivers and Harbors. (Smith-Fla)
W69-07655

SOIL CONSERVATION.

Minn Stat Ann secs 40.01-40.03 (1963).

Descriptors: *Minnesota, *Soil conservation, *Soil erosion, Legislation, State governments, Federal government, Floods, Diseases, Droughts, Administration, Administrative agencies, Standards, Legal aspects.

It is the declared public policy of the state to prevent soil erosion, floods, water shortages, disease, and general suffering resulting therefrom. In line with this policy a soil and water conservation commission is established, consisting of nine members, five of whom must be operating farmers. The commission shall have the powers and duties to assist and supervise soil conservation districts, to coordinate the programs of the several districts, to secure the cooperation of the federal government, to disseminate soil conservation information, and to subdivide or consolidate conservation districts. Provisions are set out for the establishment of soil conservation districts by petition of landowners. (Kahle-Fla)

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W69-07676

WATERSHED IMPROVEMENT DISTRICTS.
W Va Code Ann secs 19-21B-1 through 19-21B-13 (1966).

Descriptors: *West Virginia, *Watershed management, *Watersheds (Basins), Water users, Soil conservation, Legislation, Public health, Public benefits, Local governments, State governments, Water resources, Water resources development, Water utilization.
Identifiers: Soil conservation districts, Watershed improvement district.

Landowners within a soil conservation district may petition the supervisors of the district for the establishment of a watershed improvement district. Requirements for the petition are set out. The supervisors shall hold a public hearing and establish a watershed improvement district whenever conservation, development or utilization of water will be promoted by the construction of improvements and where there is a need in the interest of public health, safety or welfare for the organization of such a district. When established the district constitutes a governmental division of the state and a public body corporate with all the powers of the soil conservation district in which it is situated. The supervisors of the soil conservation district shall be the governing body of the watershed improvement district and may appoint three landowners in the district as trustees to carry out the business of the watershed improvement district. The district may be discontinued after five years by petition made in same manner as was necessary for its creation. (Kahle-Fla)
W69-07688

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

EVALUATION OF NITRIFICATION IN STREAMS,
Michigan Univ., Ann Arbor. Dept. of Environmental Health.
Chester T. Wezernak, and John J. Gannon.
ASCE Proc, J Sanit Eng Div, Vol 94, No SA5, Pap 6159, pp 883-895, Oct 1968. 13 p, 5 fig, 7 tab, 18 ref, append. PHS Proj No 70. Grant NIH I Sol FR 5447-05 GRS and WP-15 (FWPCA).

Descriptors: *Nitrification, *Chemical oxygen demand, *Streams, *Michigan, Sampling, Chemical analysis, Ammonia, Nitrates, Nitrogen compounds, Inorganic compounds.
Identifiers: *Clinton River (Mich).

A simplified procedure for evaluating nitrification progression in a stream by sampling and analyses is given. Data are presented for the Clinton River between Pontiac and Rochester, Mich, which show rapid inorganic nitrogen oxidation in this section of the river. Graphical and analytical techniques for evaluating nitrification parameters and progression are described. (Knapp-USGS)
W69-07521

5B. Sources of Pollution

PROBLEMS OF POLLUTION OF IRRIGATION WATERS IN ARID REGIONS,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering; and Federal Water Pollution Control Administration, Ada, Okla.
H. B. Peterson, A. A. Bishop, J. P. Law, and Robert S. Kerr.
International Conference on Arid Lands in a Changing World, Arizona University, Tucson, June 3-13, 1969. 21 p, 3 fig, 27 ref.

Descriptors: *Water quality, *Water pollution sources, *Return flow, *Irrigation effects, Arid lands, Sediments, Saline water, Drainage effects, Consumptive use, Reuse, Disposal, Runways, Fertilizers, Pesticide residues, Impaired water quality, Radioactive wastes, DDT, Animal wastes (Wildlife), Dissolved solids, Heavy metals, Industrial wastes, Farm wastes, Municipal wastes, Nematodes, Nitrates, Organic wastes, Phosphates, Pollutants.

Sources and types of water pollution, both natural and man related, and their relation to irrigation agriculture in afferent and efferent roles are discussed. Sources of natural pollution described are salts, sediments, animal wastes, plant nutrients, and toxic elements. Sources of agricultural pollution detailed are concentration of salts under irrigation, plant nutrients from fertilizers (nitrogen and phosphorus), wastes from animal-feeding operations and pesticides (directly and as break-down compounds). Pollutants of industrial waste of particular concern to irrigated agriculture include total dissolved solids, sodium, chlorides, boron, heavy metals, pesticides, radio-activity and numerous organics. Water quality needs of irrigated agriculture are briefly considered and probable changes in quality as a result of irrigation are detailed. Several methods to regulate pollutants in return flow are presented, as are ways of reducing the salt loading effect of waters. Several possible benefits of irrigation treatment of water are listed. (Sherbrooke-Ariz)
W69-07355

DEGRADATION OF GAMMA-BHC IN SIMULATED LAKE IMPOUNDMENTS AS AFFECTED BY AERATION,
Wisconsin Univ., Madison. Dept. of Soils.
For primary bibliographic entry see Field 05G.
W69-07364

ORGANIC PRODUCTION IN A TROPICAL ESTUARY,
National Inst. of Oceanography, Cochin (India). Biological Oceanographic Div.
S. Z. Qasim, S. Wellershaus, P. M. A. Bhattathiri, and S. A. H. Abidi.
Proc Indian Acad Sci, Vol 69, No 2, Sect B, pp 51-94, Feb 1969. 44 p, 11 fig, 8 tab, 69 ref.

Descriptors: *Organic matter, *Productivity, *Tropical regions, *Estuarine environment, Carbon, Radioisotopes, Photosynthesis, Water temperature, Seasonal, Pollutant identification, Pollutants, Chlorophyll, Nutrients, Zooplankton.
Identifiers: *India, Cochin backwater estuary, Organic production, Tropical estuary.

Daily and seasonal rates of primary production in tropical estuaries and their critical appraisal were investigated on the basis of observations recorded at four stations located in the upper reaches of the Cochin Backwater estuary, and several earlier publications. The article contains the following sections: (1) introduction; (2) procedure and methods; (3) the environment; (4) rate of photosynthesis; (5) incubation time and diurnal rhythm; (6) photosynthesis as a function of illumination; (7) gross and net production; (8) seasonal changes in production rates; (9) factors influencing organic production; (10) estimation of production from radiation and chlorophyll; (11) productivity in relation to particular matter; (12) annual production; (13) efficiency; and (14) productivity in relation to zooplankton. The study shows that in a highly turbid and polluted estuary the C-14 assimilation is nearer to net production and the diurnal rhythm in photosynthesis is associated with the increase and decrease in daily illumination. Seasonal changes in the production rates are not well marked and show only 3- to 4-fold increase in certain months. The study also shows that for most of the year, primary production seemed nonexistent at depths greater than about 4 m and temperature and nutrients are not limiting factors in the estuary. (Gabriel-USGS)
W69-07388

DETERGENTS AND GROUNDWATER SUPP (FRENCH),
CERH Montpellier (France). Dept. of Sciences
R. Plegat, and C. Armangau.
Terres and Eaux, Rev Int de L' Hydraul, Vol 22 58, pp 19-28, Jan-Mar 1969. 10 p, 11 fig, 1 tab ref.

Descriptors: *Aquifers, *Water supply, *De gents, Water table, Streamflow, Hydraulic mo Boreholes, Rivers, Water analysis, Water circ tion, Tertiary period, Hydrodynamics, W Hydrologic data, Geology, Sedimentary ro Sands, Gravels, Marls, Mapping, Topogra Pumping, Water storage, Pollutants.

Because the use of detergents is very commo the Lez Valley, the detection and localizatio water circulation was made by analyzing the c tent of detergents in the water of streams aquifers. By combining the chemical analysi stream and borehole water samples with hydraulic river data, the circulation of water f the river to the aquifers was well recogni (Gabriel-USGS)
W69-07390

OXYGEN DYNAMICS AND ECONO GROWTH IN THE MILLSTONE RIVER,
Rutgers - The State Univ., New Brunswick, N. J.
William Whipple, Jr., and M. Marcus.
American Society of Mechanical Engineers PID-8. Presented at ASME-AIChE Joint C ference on Stream Pollution and Abatement, J 10-12, 1969. 9 p, 8 fig, 5 tab.

Descriptors: *Organic loading, *Water pollu source, *Biochemical oxygen demand, Oxygen Economics, Economic prediction, Water pollu effects, Stream pollution, Water quality.
Identifiers: *Oxygen dynamics, *Unrecorded ganic loading, Unrecorded pollution, BOD conc tration, BOD loading.

The Millstone River is a small stream used water supply purposes in a rapidly urbanizing of Northern New Jersey. A study of its organic lution and biochemical oxygen demand was m in order to correlate the gross man-made w load with growth of population and of industr the area. This study has been successful in estim ing the organic loading of the river and its princ tributaries, over an eleven year period, and in c puting how much of a pollution load must h been placed in the water in various areas in orde account for the pollution remaining downstrea was shown that gross pollution load, inclu recorded waste loads removed by waste treatm plants increased more than proportionately either population growth or manufacturing activ The most astonishing finding was that the orga loading due to recorded treatment plants efflu was only about half of the apparently man-made ganic loading from other sources. This finding very serious implications from the viewpoint water pollution control program depending so upon treatment of recorded effluents. (Whipp Rutgers)
W69-07445

WATER POLLUTION ASPECTS OF URB RUNOFF; THE CAUSES AND REMEDIES WATER POLLUTION FROM SURFA DRAINAGE OF URBAN AREAS.
American Public Works Association, Chicago. Research Foundation.

FWPCA Publication No WP-20-15, January, 19 272 p, 32 tab, 12 fig, 26 ref, 6 append. WA-66 (FWPCA). APWA Research Project No 120.

Descriptors: Sewers, Pesticides, Corrosion cont Economics, *Urbanization, Legislation.
Identifiers: *Environmental pollution, *St water pollution, *Urban drainage, Street ref Air pollution dustfall, Catch basins, St sweepers efficiency, *Storm sewers, Sewer sol Combined sewers, Salt-ice control, Corrosion hibitors, Guideliners, Roof runoff.

:nvironmental pollution factors and their
tial pollutional effects resulting from the
wastes interfacial contracts during precipita-
id runoff have been analysed based upon col-
field data and theoretical calculations. The
e urban environment factors studied in-
l, street refuse and litter, catch basins, en-
nentally used chemicals, contributions from
llution and its control, and sewer solids
ition. It was found that street refuse could
it a significant pollution load. It is estimated
pollution load (measured in terms of BOD)
one percent of the total raw sewage or five
nt of the total secondary treatment effluent in
of average daily load, and (b) 160 percent of
w sewage and 800 percent of the secondary
nt load, expressed in terms of the shock pollu-
oad on the receiving body of water results
he dust/dirt fraction of street litter. Findings
ecommendations are presented in summary
Raw data collected, survey questionnaires,
comprehensive set of 'typical' ordinances
ning a wide sampling of possible sources of
storm water pollution are compiled in the re-

07453

KILL IN BOONE RESERVOIR - JULY 9-
68.
ssee Valley Authority, Chattanooga.

Valley Authority, Dec 1968, 65 pp, 1 photo,
4 tab, 3 append, 1 ref.

iptors: Tennessee Valley Authority, Tennes-
ver, *Fishkill, Water pollution, *Water pollu-
sources, Water pollution effects, Water
stry, Environmental effects, *Pollutant
fication, Bioassay, *Chemical wastes, Pesti-
esidues.
fiers: Watauga River, Boone Reservoir.

g the 5-day period July 9 through 13, 1968,
than 500,000 fish were killed in the Watauga
f Boone Reservoir in northeast Tennessee.
ish were killed by a toxic compound of
al mercury that leaked out of a 55-gallon
drum. Many such drums are used for flotation
ses at boat docks, and many have become
cts. The cause of the kill was difficult to track
and it was not until all the more common
s of fish-kill were eliminated that a toxic
ial and its source were pinpointed. Con-
ble scientific detective work was necessary to
the toxicant, and much laboratory and field
was involved. Several laboratories and agen-
cooperated in the investigation. The report
nents the procedures followed in establishing
use of the fish-kill. (Ingram-TVA)
07461

EMENT OF POLLUTION FROM MINE
EWATERS,
tment of Energy, Mines and Resources, Ot-
Ontario). Inland Waters Branch.
Schmidt, and K. Conn.
Mining J, Vol 90, No 6, pp 54-60, June 1969. 7
g, 7 tab, 9 ref.

iptors: *Pollution abatement, *Waste water
ition), *Ponds, *Waste water treatment,
ical analysis, Acidic water, Mine water,
al industry, Pyrite, Copper, Calcium, Iron,
analysis, Organic compounds, Oxygen, Sodi-
otassium, Bacteria.
fiers: Mine wastewater pollution abatement.

paper reports on a study of acid generation
the tailings pond system and effluent receiv-
ream of a base metal mine located in the
eastern part of New Brunswick, Canada. The
under investigation contains a sulphide ore
and the effluent from the mine is discharged
South Little River. The study shows that the
anism of acid generation is due to the follow-
l) the formation and subsequent precipitation
icium carbonate; (2) the chemical oxidation
rtially oxidized sulphur compounds; and (3)
the precipitation of sulphite. Within the receiving stream the generation of acid is caused by the continuing chemical oxidation of sulphur compounds and, predominantly, by the bacteriological utilization of the thionates to produce sulphuric acid. Some possible treatment of wastes is also given. (Gabriel-USGS)
W69-07490

EVALUATION OF NITRIFICATION IN STREAMS,
Michigan Univ., Ann Arbor. Dept. of Environmental Health.
For primary bibliographic entry see Field 05A.
W69-07521

POLLUTION FORECASTING IN AN ESTUARY (JAPANESE),
Tokyo Univ. (Japan). Dept. of Urban and Sanitary Engineering.
Akinori Sugiki.
J Fac Eng, Tokyo Univ, Ser A, Annu Rep No 6, pp 12-13, 1968. 2 p, 5 fig, 2 ref.

Descriptors: *Pollutant identification, *Pollutants, *Estuaries, Estuarine environment, Oxygen, Oxygenation, Mathematical studies, Mixing, Aeration, Bottom sediments, Nitrogen compounds, Sulfur compounds.
Identifiers: Estuary pollution.

This study was undertaken for the purpose of elucidating the mechanism of estuary pollution, using the Sumida estuary as an example and analyzing the factors affecting the oxygen balance of polluted waters. The study shows that a mixing theory developed for the Thames river estuary is the most reliable for forecasting the conditions of pollution in a strongly mixed estuary. The study also gives a clear understanding of deoxygenation, reaeration and oxygen consumption by bottom deposits, and other estuary parameters in the process of estuary pollution. The 1975 and 1985 pollutional loads of the sumida estuary were estimated and presented in this investigation. (Gabriel-USGS)
W69-07530

WASTE WATER RECHARGE AND DISPERSION IN POROUS MEDIA,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
John Austin Hoopes, and Donald R. F. Harleman.
Mass Inst Tech Hydrodynamics Lab Rep No 75, June 1965. 166 p, 40 fig, 3 tab, 120 ref. PHS Grant No WP-347.

Descriptors: *Path of pollutants, *Groundwater movement, *Diffusion, *Dispersion, *Mathematical models, Model studies, Hydraulic models, Tracers, Injection wells, Artificial recharge, Convection, Mixing, Flow, Porous media.
Identifiers: Disposal wells.

The effects of dispersion and diffusion of wastewater solutes in aquifers near the injection wells are incorporated in a mass conservation equation. Solutions are derived to predict the tracer distributions resulting from various recharge and disposal operations. For uniform flow, the longitudinal and lateral dispersion coefficients are related to the seepage velocity, particle size, and media structure. These coefficients are determined from experimental measurements of the distribution of a dilute salt tracer in flow through a sand column. Convection and dispersion determine the tracer distribution near the well. At larger distances from the well, molecular diffusion and convection alone are important. With a pair of wells, one recharging tracer fluid and the other pumping the mixture of tracer and native groundwater, the solution for the tracer distribution indicates that lateral dispersion has a negligible influence on the tracer distribution, except very near the line joining the two wells. Molecular diffusion is also shown to be insignificant, except for small flow rates and large well-spacings. Longitudinal dispersion determines the shape of the tracer distribution within the media, whereas convection dominates the tracer distribution at the pumping well, except for short times. (Knapp-USGS)
W69-07554

NAVIGATION AND NAVIGABLE WATERS.
For primary bibliographic entry see Field 05G.
W69-07660

POLLUTION OF STREAMS.
For primary bibliographic entry see Field 05G.
W69-07697

5C. Effects of Pollution

EUTROPHICATION STUDIES IN A SHALLOW INLET ON VANCOUVER ISLAND,
Fisheries Research Board, Nanaimo (British Columbia). Biological Station.
Michael Waldichuk.
J Water Pollut Contr Federation, Vol 41, No 5, Part 1, pp 745-764, May 1969. 15 fig, 2 tab, 14 ref.

Descriptors: *Eutrophication, *Estuaries, *Nutrients, Municipal wastes, Industrial wastes, Salinity, Water temperature, Water pollution, Water pollution effects, Dissolved oxygen, Phosphates, Nitrates, Ecology.
Identifiers: *Canada, Vancouver Island, Juan de Fuca Strait.

Thirteen sampling stations were established in the Victoria Harbor, B. C., Canada, area to establish the gradient of temperature, salinity, dissolved oxygen, pH, phosphate, nitrate, ammonia, soluble carbon, and chlorophyll from the relatively uncontaminated Juan de Fuca Strait to the heavily polluted Portage Inlet and tributary waters. While the input of nutrients into the inlet is not large, the volume of the system is so small and flushing so poor that nutrients become concentrated, particularly during the summer months when phosphates and nitrates are absorbed by the plankton and deposited on the bottom. From all practical points of view, there is little solution to this enrichment problem short of removal of all nutrient sources. The plan envisaged by the Provincial Government to cut a canal through the Thetis Cove to Portage Inlet, and by a system of locks to provide a means of rapidly flushing the system, seems to be a good solution to the eutrophication problem. However, the ecology will be modified considerably and the temperature in Portage Inlet during the summer months will be much reduced, making it less suitable for bathing. (Knapp-USGS)
W69-07361

POTENTIAL POLLUTIONAL EFFECTS IN DEEP LAKES,
Environmental Control Administration, Cincinnati, Ohio.
Henning Eklund.
J Water Pollut Contr Federation, Vol 41, No 5, Part 2, pp R155-R159, May 1969. 5 p, 3 fig, 9 ref.

Descriptors: *Lakes, *Thermal stratification, Dissolved oxygen, Water pollution, Nutrients, Biochemical oxygen demand, Epilimnion, Hypolimnion, Thermocline, Water temperature, Turnovers, Water circulation.
Identifiers: Deep lakes.

The annual circulation of deep lakes is not as simple as that for shallow lakes. The hypolimnion of a deep lake may contain an inherent stability independent of the stability associated with a thermocline. It appears that deep lakes do not necessarily turn over every year. If this is true and the dissolved oxygen in the hypolimnion becomes depleted it might be several years before the oxygen would be replenished through complete overturn of the lake. Directly contributed biochemical-oxygen-demanding material, plankton that develop from nutrient buildup, and biochemical-oxygen-de-

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manding material released by anaerobic decomposition conceivably cause this oxygen depletion which might last for an extended period. (Knapp-USGS)
W69-07363

THE ROLE OF ALGAE IN THE BIOLOGICAL TREATMENT OF WATER (FRENCH),
IRCHA (France). Microbiology Service.
R. Cabridenc, and H. Lepailleur.
Terres and Eaux, Rev Int de L'Hydraul, Vol 22, No 58, pp 12-18, Jan-Mar 1969. 7 p, 7 fig, 1 tab, 25 ref.

Descriptors: *Algae, *Biological treatment, *Water treatment, *Pollutant identification, *Pollutant abatement, Effluents, Streamflow, Desalination, Tertiary treatment, Lagoons, Oxygenation, Absorption, Ecology, Water purification, Carbon, Bicarbonates, Photosynthesis, Nutrients, Microbiology.
Identifiers: Water purification by algae.

The role of algae, as a desalination and purification agent, was investigated on the basis of earlier publications and recent experiments conducted by the authors. The study shows that oxygen liberated in the course of photosynthesis leads to the oxygenation of aquatic media and considerable reduction of pathogenic germs. The study also shows that there is competition between algae and other microorganisms; however, in the present state of knowledge, the problem of interaction due to the production by algae of inhibiting or activating substances is still not clearly understood. The degree of purification of water by the lagooning process, in many cases is equivalent to, or greater than that obtained by other biological processes. (Gabriel-USGS)
W69-07389

REAERATION MEASUREMENTS IN A EUTROPHIC STREAM,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05G.
W69-07420

THE ACTINOMYCETES,
Rutgers - The State Univ., New Brunswick, N. J. Inst. of Microbiology.
Hubert Lechevalier.
Proc Rudolfs Res Conf, Rutgers Univ, New Brunswick, NJ. Principles and Applications in Aquatic Microbiology, Heukelekian, H and Dondero, Norman C (eds), John Wiley and Sons, Inc, New York, pp 230-253, 1964. 10 fig, 1 tab, 43 ref, disc.

Descriptors: *Classification, *Actinomycetes, Bacteria, Fungi, Microorganisms, Spores, Viruses, Antibiotics (Pesticides), Anaerobic conditions, Cultures, Isolation, Sampling, Oxygen, Soil microorganisms, Mud, Temperature, Saline water, Electron microscopy, Bacteriophage, Hydrogen sulfide, Rubber, Foods, Biodegradation, Farm wastes.
Identifiers: Actinophages, Gram-positive bacteria, Lysozyme, Media, Chemical composition, Morphology, Cellular size, Sporangia, Hyphae, Mycelium, Chemical content, Bright field microscopy, Cell wall, Actinomycoses, Contaminants, Nuclear membrane, Termites, Pericarditis, Leprosy, Pneumonia, Nocardiosis, Farcy, Tumefactions, Potato scab, Wool, Leather, Diaminopimelic acid isomer.

Actinomycetes produce most antibiotics. Electron microscopic observations established them taxononically as bacteria. Cellular size, cellular contents, and absence of membrane around the nuclear material show striking relationships. Actinomycetes are hosts to phages of their own that are similar to bacteriophages both in action and in morphology. They are sensitive to strictly antibacterial antibiotics and resistant to strictly antifungal antibiotics. The mucoid nature of their cell walls is similar to certain Gram-positive bacteria. Enzymatic studies clearly differentiate the walls of actinomycetes from those of fungi. There are strictly anaerobic forms among actinomycetes and bacteria but not among fungi. Isolation of pure cultures was best made on lean media not favorable to true bacteria. A morphological distinction depends upon the growth of spores on aerial or substrate mycelium. Since actinomycetes are bacteria with fungal morphology, methods of morphological studies are those of fungi. The key to the genera is morphologic, but the chemical composition of the cell walls is also a deciding factor. Natural distribution of the ten genera is wide. Soil is their greatest reservoir. They are salt-tolerant and found in marine microflora. Fish pick up from them and store a substance with undesirable tastes and odors. For main entry see W69-07423. (Jones-Wisc)
W69-07424

ARTHROBACTER,
Agricultural Univ., Wageningen (Netherlands). Lab. of Microbiology.
E. G. Mulder.
Proc Rudolfs Res Conf, Rutgers Univ, New Brunswick, NJ. Principles and Applications in Aquatic Microbiology, Heukelekian, H and Dondero, Norman C (eds), John Wiley and Sons, New York, pp 254-279, 1964. 28 fig, 5 tab, 37 ref, disc.

Descriptors: *Classification, *Microorganisms, *Fermentation, *Water purification, *Microbiology, *Aerobic bacteria, Sludge, Plant growth, Industries, Acidicity, Temperature, Chemical properties, Carbohydrates, Nitrogen compounds, Vitamins, Yeasts, Mycobacterium, Amino acids, Degradation (Decomposition), Cellulose, Herbicides, Lignins, Phenolds, Desiccants.
Identifiers: *Morphology, *Physiology, *Pleomorphism, *Decompose, Cheese, Cystites, Biotin, Cellulomonas biazotea, Microbacterium, Brevibacterium linens, Corynebacteriaceae, Nocardia, Polysaccharides, Micrococcus.

Microorganisms of the Arthrobacter type are important in soil, water, and industrial microbiology. In coccoid state, they are part of autochthonous flora and in rod form, of zymogenous flora. Habitat includes activated sludge, certain cheese, and plants. Certain strains attack compounds which normally are not attacked by microorganisms; some produce compounds which have commercial value. In the coccus stage resistant to prolonged desiccation even beyond 10 months, soil arthrobacters synthesize polysaccharides; excrete amino acids; give active phage suspension; and decompose cellulose, lignin, phenols and certain herbicides. Strains from activated sludge strongly decompose carbohydrates. The various Arthrobacter strains are morphologically similar but physiologically different. Isolation and identification depends on chemistry of media, temperature, and acidity. Nutrients and age affect morphology. Aerobic, pleomorphic characteristics are evident. Diverse Arthrobacter strains are morphologically similar to Brevibacterium linens, Cellulomonas biazotea, and Mycobacterium phlei. Gram-negative or Gram-variable in rod stage in soil, arthrobacters shifted to Gram-variable in coccoid form; reverse was also found. Strains from activated sludge, except those with phenol-decomposing capacity, reacted like soil strains. Utilization of nitrogen compounds and vitamin requirements affect classification. Arthrobacter from soil and sludge can utilize inorganic nitrogen either without vitamins or with biotin. For main entry see W69-07423. (Jones-Wisc)
W69-07425

HYDROCARBON STRUCTURE: ITS EFFECT ON BACTERIAL UTILIZATION OF ALKANES,
Iowa Univ., Iowa City. Dept. of Microbiology.
Eva J. McKenna, and R. E. Kallio.
Proc Rudolfs Res Conf Rutgers Univ, New Brunswick, NJ. Principles and Applications in Aquatic Microbiology, Heukelekian, H and Dondero, Norman C (eds), John Wiley and Sons, New York, pp 1-14, 1964. 8 fig, 4 ref, disc.

Descriptors: *Molecular structure, *B
*Microorganisms, *Yeasts, *Fungi, Oxi
Manometers, Enzymes, Detergents, Biod
tion.
Identifiers: Hydrocarbons, Nocardia co
Micrococcus, Pseudomonas, Mycobact
Isomerization, Alkanes, Utilization, Paraffins

Structures of hydrocarbons, added to
media, were tested for microbial growth sus
properties. Studies with hexadecane isomer
the questions of the effect of more than one
substituent on a normal alkane chain and the
of larger hydrocarbon substitutions on an
chain. Prestane, squalene, and a few
branched hydrocarbons support growth.
more than one methyl group appears on a
atom, particularly if the carbon atom is the p
mate carbon, the resulting hydrocarbon is ex
ly resistant to microbial degradation. Groups
than methyl (propyl or phenyl) appear to p
utilization. Current concensus in the deterg
dustry indicates alkyl benzene sulfonate de
tion begins at the alkyl portion of the molecu
strains of alkane-utilizing micrococci were
for their ability to grow at the expense of a s
phenyl alkanes. All test organisms utilize 1-
dodecane. Utilization of the phenyl
decreases as the phenyl is moved along the sk
to the carbon-six position. Length of the tot
chain is not the sole criterions of availabi
number of alkanes are oxidized by org
without serving as carbon sources, raisi
question of true oxidation versus stimulation
torespiration. For main entry see W69-
(Jones-Wisc)
W69-07426

**MICROBIOLOGY OF PESTICIDES AN
LATED HYDROCARBONS,**
Cornell Univ., Ithaca, N. Y. Lab. o
Microbiology.
Martin Alexander.
Proc Rudolfs Res Conf Rutgers Univ, New
swick, NJ. Principles and Applications in A
Microbiology, Heukelekian, H and Dondero
man C (eds), John Wiley and Sons, New Yo
15-42, 1964. 10 fig, 7 tab, 25 ref, append, dis

Descriptors: *Pesticides, *Herbicides, *Fung
*Insecticides, *Microbiology, *Che
*Molecular structure, *Decomposing
matter, Ecology, Biochemistry, Soils, To
Aquatic microbiology, Public health, Physio
ecology, Detergents, Industries, Poll
Biodegradation, Phenolic pesticides, Ha
Chromatography, Bioassay, Bacteria, Fung
tionomycetes, Spectrophotometry, Ultr
radiation.
Identifiers: Hydrocarbons, Inactivation, D
tion, Nocardia, Flavorbacterium, Pseudomon
termediates, Achromobacter, Tricho
Arthrobacter, Alcaligenes, Corynebacterium

Pesticides may be leached, decomposed,
tivated by colloidal materials, dissipated
volatile, or degraded microbiologically. Los
recorded by gas chromatograph, bioassay, a
tain indirect tests, relying upon properties p
to the compound. Mainly bacteria, few fun
actinomycetes, affect herbicide decompo
Structures of 2,4-D and 2,4,5-trichlorop
yacetic acid were studied by spectrophoto
methods to establish time of aromati
cleavage, by plant bioassay techniques, and b
cultures. Ultraviolet absorption disappear
substance degradation. No compound, hav
its aromatic nucleus a chlorine in positions 3
transformed sufficiently to cause significant
ultraviolet absorption. Point of linkage of th
acid side chain regulates susceptibility of th
matic portion of the molecule to microbial
The only phenols persisting more than ten
had at least one halogen in positions 3
Mechanism of microbial decomposition of
termediates is little known. Degradation of p
y compounds, having an even number of car
the sidechain, proceeds via the butyrate deri
and, with an odd number of carbons,

ionate and pentanoate derivatives. anisms for metabolism of phenoxyalkanoic herbicides are beta-oxidation of the aliphatic ty and cleavage of the ether linkage. For main see W69-07423. (Jones-Wisc)
-07427

ROBIAL TRANSFORMATIONS OF ERALS,
selaer Polytechnic Inst., Troy, N. Y. Dept. of gy.
y L. Ehrlich.
Rudolfs Res Conf, Rutgers Univ, New Brun-, NJ. Principles and Applications in Aquatic obiology, Heukelekian, H and Dondero, Nor-C (eds), John Wiley and Sons, New York, pp), 1964. 5 fig, 43 ref, disc.

riptors: *Microbiology, *Mineralogy, roorganisms, *Water pollution, *Water purifi-n, *Bacteria, *Enzymes, Corrosion, Oxida-Reduction (Chemical), Hydrolysis, Chelation, i, Algae, Protozoa, Lichens, Plants, Diatoms, , Mollusks, Mine acids, Coal mines, Acidity, e, Sulfur compounds, Molybdenum, Rotifers, ystems, Photosynthesis, Environment, Aque-olutions, Terrestrial habitats, Iron compounds, anese, Trophic level.
ifiers: *Mineral transformation, Metazoa, laria, Foraminifera, Thiobacillus-Ferrobacil-hiobacillus denitrificans, W Virginia, Pennsyl-, Marcasite, Chalcocite, Covellite, Sphalerite, rite, Orpiment, Tetrahedrite, Bornite, Chalco-, Chemosynthesis, Concretions, obacter, Pyrophosphate, Orthophosphate, utation, Tannins.

gical processes of some microorganisms, ially bacteria, cause transformation of al matter. Involved are direct enzymic in-ion--oxidations and reductions, hydrolysis, te destruction--and, indirect nonenzymic in-ion--insoluble matter corrosion by metaboli-produced acid, inorganic ions precipitation by metabolically-produced inorganic ions, ad-on onto cell surfaces, and metal chelate for-n. The bacterial chemosynthetic autotrophs ineral oxidation as a chemical energy source, ing power for the synthesis of organic matter carbon dioxide and water. Oxidation of metal es and of Fe (II) to Fe (III) takes place. Bac-photosynthetic autotrophs use mineral oxida-nerely as a source of reducing power in car-lioxide assimilation, depending on radiation energy. The enzyme, inorganic hosphatase, present in bacteria, is probably lyzed to orthophosphate. Pyrophosphate can lex Mn (III) and hydrolysis could lead to the precipitation. Enzymic breakdown of the ing agent by bacteria may result in precipitat-e metal ions. The nonenzymic interactions d on end products of metabolism, acids act on acid-soluble minerals. Some itations may form amorphous or crystalline nerates. In adsorption, iron and manganese s possibly form into encrustations. In chela-a metabolically produced organic compound complex one or another metal ion. For main see W69-07423. (Jones-Wisc)
07428

E OBSERVATIONS OF THE SPHAEROTI-EPTOTHRIX GROUP,
s Univ., Urbana. Lab. of Microbiology.
Mulder.
Rudolfs Res Conf, Rutgers Univ, New Brun-, NJ. Principles and Applications in Aquatic biology, Heukelekian, H and Dondero, Nor-C (eds), John Wiley and Sons, New York, pp 2, 1964. 21 fig, 6 ref, disc.

iptors: *Classification, *Bacteria, Microor-n, Enzymes, Oxidation, Iron, Manganese, res, Nitrogen compounds, Carbon, Vitamins, es, Soil water, Sewage bacteria, Waste water tion), Activated sludge, Habitats.

Identifiers: *Chlamydobacteria, *Morphology, *Physiology, Media, Poly-beta-hydroxybutric acid, Sphaerotilus natans, Leptothrix ochracea, Leptothrix lopholea, Leptothrix pseudo-ochracea n sp, Leptothrix cholodnii n sp, Leptothrix discophora, Sheaths.

Morphological and physiological characters of strains of Sphaerotilus-Leptothrix bacteria were studied in slowly-running sterile soil extract containing ferrous iron, on agar media, and in cultures with or without manganese salts. The effect of nitrogenous and carbon compounds and of vitamins was tested. Isolated from activated sludge, waste water, and running ditch water containing iron precipitates, all members of the group can be grown in synthetic media containing glucose, aspartic or glutamic acids, and vitamin B-12. All oxidize manganous salts, except Type I. Their cells contain globules of poly-beta-hydroxybutic acid. Type I, Sphaerotilus natans, with long sheaths, differs from Leptothrix ochracea. Nutrients affect presence of sheaths and smoothness of colony edges. Types II and III have large cells resembling S natans, but differ in utilization of organic nutrients. Type II, Leptothrix lopholea, forms fungus-like flocks of short trichomes, radiating from a common holdfast in liquid media. Type III, Leptothrix pseudo-ochracea n sp, resembles Leptothrix ochracea with shorter and frequently empty sheaths. Type IV, Leptothrix cholodnii n sp, forms filamentous colonies, large, white and smooth, or black-brown, dependent on the media. Type V, Leptothrix discophora, has smaller cells than Type IV, smaller colonies than the other types, and are filamentous or smooth. For main entry see W69-07423. (Jones-Wisc)
W69-07429

RIVER BACTERIOLOGY AND THE ROLE OF BACTERIA IN SELF-PURIFICATION OF RIVERS,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
Karl Wuhrmann.
Proc Rudolfs Res Conf, Rutgers Univ, New Brunswick, NJ. Principles and Applications in Aquatic Microbiology, Heukelekian, H and Dondero, Norman C (eds), John Wiley and Sons, New York, pp 167-192, 1964. 5 fig, 2 tab, 7 ref, disc.

Descriptors: *Bacteria, *Rivers, *Self-purification, *Currents (Water), Ecology, Pollutants, Recreation, Water supply, Oxygen, Habitats, Biomass, Soil microbiology, Fungi, Flow, Velocity, Temperature, Plants, Groundwater, Sewage, Mosses, Diatoms, Phenols, Biochemical oxygen demand, Ammonium compounds, Nitrogen compounds, Alkalinity, Degradation (Decomposition), Metabolism, Hydrography, Oxygen sag, Chemical analysis, Rates, Parametric hydrology.
Identifiers: Glucose, Sphaerotilus natans, Beggiatoa, Biotopes, River Nile, Soil water, Fontinalis, Amblystegium, Hormidium, Thiobacillus, Leptothrix, Fusarium, Leptomitus lacteus, Hydrocarbons, Zoogloea, Carchesium polyp, Vorticella sp, Synedra ulna, Nitzschia palea, Zurich, Elimination, Autotrophs, Heterotrophs, Time.

Water current is important synecologically but has no autoecological significance to bacteria in rivers. In two experimental rivers, with waters of different quality, the proportion of the freely suspended bacteria was less than 1% that of the epiphytic. A third large group of bacteria, the epibenthic, is especially numerous in polluted streams. Majority of bacteria in rivers are introduced by washings from soil or with sewage. The hygienic types are not important ecologically. Unique mass developments of certain bacteria or fungi observed in streams have no parallel in soil microbiology. It is doubtful whether flow velocity exerts direct physiological influence essential for growth. Self-purification, defined as removal of organic compounds from water by the metabolism of microorganisms, is estimated quantitatively on the results of recognized analytical procedures for individual chemical compounds, or, for a known group of compounds. Biochemical oxygen demand values do not fulfill this requirement. Model rivers controlling ecological factors were assayed. Self-purification rate is highly dependent on absolute quantity of biomass in intimate contact with flowing water. The simultaneous quantitative and qualitative estimate of acting microorganisms and qualitative measure of self-purification of defined chemical compounds are significant. For main entry see W69-07423. (Jones-Wisc)
W69-07431

THE ECOLOGICAL ROLE OF PHOSPHORUS IN WATERS WITH SPECIAL REFERENCE TO MICROORGANISMS,
Dalhousie Univ., Halifax, Nova Scotia. Dept. of Biology.
John E. Phillips.
Proc Rudolfs Res Conf, Rutgers Univ, New Brunswick, NJ. Principles and Applications in Aquatic Microbiology, Heukelekian, H and Dondero, Norman C (eds), John Wiley and Sons, New York, pp 61-81, 1964. 13 fig, 14 ref, disc.

Descriptors: *Phosphorus, *Phosphorus radioisotopes, *Ecology, *Water, *Microorganisms, *Bacteria, Phytoplankton, Zooplankton, Plants, Sediments, Mud-water interfaces, Radioactivity, Cores, Invertebrates, Sea water, Phosphorus compounds, Lakes, Chromatography, Mud, Temperature, Light, Density.
Identifiers: Antibiotics, Terramycin, Tetracycline, Eriocaulon, Sphagnum, Utricularia, Gammarus locusta (Marine), Halifax (NS), Nostoc, Fucus vesiculosus, Scanner.

Phosphorus level may limit the productivity of lakes and oceans. Microorganisms are important in the continual exchange of phosphorus between the water phase, the sediments, higher plants, and zooplankton. Water bacteria reduce the rate of exchange and hold more phosphorus in the water. Normal competition for phosphorus exists between the various solid phases. Rapid uptake of radiophosphorus by Gammarus in the presence of bacteria shows that higher invertebrates obtain their food by digestion of particulate matter rather than by direct absorption of dissolved inorganic or organic compounds, thus microorganisms play an essential role in making phosphorus available to zooplankton and hence to higher groups in the food chain. Conversion of dissolved inorgnic phosphate to dissolved organic phosphorus through the intermediate activity of bacteria is a reversible process. There is no direct reconversion of dissolved organic phosphorus to inorganic phosphate without intermediate incorporation into the bacteria. Preliminary integration of time relationship of the several phosphorus reactions which might occur in a lake or bay is warranted. On adding phosphate to water, the immediate reaction is the transfer through the bodies of unicellular suspended life forms. Time depends on temperature, light, cell density and nutrient availability. For main entry see W69-07423. (Jones-Wisc)
W69-07435

AMORPHOUS CLAY FRACTION OF SOILS AND ITS ADSORPTIVE PROPERTIES. A SELECTED BIBILOGRAPHY,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 02K.
W69-07436

THE EXCHANGE OF DISSOLVED SUBSTANCES BETWEEN MUD AND WATER IN LAKES,
Freshwater Biological Association, Ambleside (England).
For primary bibliographic entry see Field 02H.
W69-07438

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A MATHEMATICAL MODEL FOR THE CONTINUOUS CULTURE OF MICROORGANISMS UTILIZING INHIBITORY SUBSTRATES,
Clemson Univ., S.C. Environmental Systems Engineering.
For primary bibliographic entry see Field 05D.
W69-07439

PROBLEMS OF BIOLOGICAL OCEANOGRAPHY.
Akademiya Nauk URSR. Inst. of Biology of Southern Seas.

Available from Clearinghouse as AEC-tr-6940 at $3.00 in paper copy and $0.65 in microfiche. Transl Vopr Biookeanograffi Materialy II Mezhdunarodnoga Okeanogr Kongr 30 May-9 June 1966. Naukova Dumka, Kiev, 1967. US Atomic Energy Comm, Translation Series AEC-tr-6940. 94 pp, 13 fig, 18 tab, 99 ref.

Descriptors: *Conferences, *Oceanography, *Translations, Algae, Crustaceans, Benthos, Brine shrimp, Ecosystems, Fish, Phytoplankton, Plankton, Radioactivity, Radioactivity effects, Radioecology, Sorption, Water pollution effects, Water pollution sources.
Identifiers: *Biological oceanography, *Transactions, Black Sea, Contact zones, Artemia, Balanus, Desorption, Embryology, Energy transformations, Heterotrophy, Organic pollution, Marine organisms, Marine associations, Moscow, Petroleum pollution, Photosynthetic pigments, Production biology, Russia, Second International Oceanographic Congress, Hyponeuston.

Tropical coverage of 16 individual contributions are as follows: Planktonic ecosystems of the Black Sea; production rate of heterotrophs; transformation of substances and energy by amphibiontic crustacea in Black Sea; energy transformation by Artemia, seasonal dynamics of algal photosynthetic pigments in Black Sea; benthos development in Mediterranean basin; ecologico-geographic development of contact zones in southern seas; influence of petroleum products on phytoplankton of seas; influence of organic pollution on development of Balanus; marine radioecology and oceanography; radioecological significance of hyponeuston; effects of radioactivity on embryology of fishes; kinetics of accumulation and exchange of radioisotopes by marine algae; artificial radioactivity of marine organisms; distribution of radioactivity in marine organisms and associations; and sorption and desorption of radionuclides in bottoms of shallow seas. (Eichhorn-Wisc)
W69-07440

SYMPOSIUM ON RADIOECOLOGY.
Ecological Society of America; Atomic Energy Commission, Washington, D. C.; and Michigan Univ., Ann Arbor.

Available from Clearinghouse as CONF 670503 at $3.00 in paper copy and $0.65 in microfiche. Proc Second National Symposium on Radioecology, Nelson, Daniel J. and Evans, Francis C (eds), Ann Arbor, Mich, 1967. 774 p, 303 fig, 207 tab, 1364 ref.

Descriptors: *Conferences, *Radioecology, Biological communitics, Ecosystems, Population, Radioactive waste disposal, Radioactivity, Radioactivity effects, Radioisotopes, Water pollution sources, Water pollution effects.
Identifiers: *Proceedings, Ann Arbor (Mich), Ecological Society of America, Freshwater environments, Marine environments, Lapland, Nuclear excavation, Radionuclide cycling, Michigan Univ, US Atomic Energy Commission, Terrestrial environments.

This report comprises Proceedings of Second National Symposium on Radioecology, convened at Ann Arbor, Mich, 15-17 May 1967, and cosponsored by US Atomic Energy Commission, Ecological Society of America, and University of Michigan. Symposium was a response to keen public awareness of diverse problems of environmental contamination from industrial and domestic pollutants, to pesticides, to radioactive wastes from weapons testing, and power plant operations. Report includes text of introductory speaker, John N Wolfe, 'Radioecology: Retrospection and Future'; and plenary session papers as follows: Chet Holifield, 'The Scientist's Responsibility in the Control of Man's Environment'; William E Martin, 'Radioecology and the Feasibility of Nuclear Canal Excavation'; J K Miettinen, 'Enrichment of Radioactivity by Arctic Ecosystems in Finnish Lapland'; and Don W Hayne, 'Implications of Radioecology for Other Research in Environmental Contamination'. Five additional sections of report, with number of individual contributions per section, follow: Population and Community Response to Radiation, (8) Individual and Species Response to Radiation, (10) Radionuclide Cycling in Freshwater Organisms and Environments, (17) Radionuclide Cycling in Marine Organisms and Environments, (21) AND Radionuclide Cycling in Terrestrial Organisms and Environments, (29) Report is indexed. (Eichhorn-Wisc)
W69-07441

GROWTH CHARACTERISTICS OF ALGAE IN RELATION TO THE PROBLEMS OF MASS CULTURE,
Carnegie Institution of Washington, Stanford, Calif. Dept. of Plant Biology.
Jack Myers.
Extracted from ALGAL CULTURE: FROM LABORATORY TO PILOT PLANT, John S Burlew, Editor. Carnegie Institution of Washington Publication 600, Washington, DC. 4 fig, 2 tab.

Descriptors: *Growth rates, *Algae, Photosynthesis, Eutrophication, Light, Temperature, Carbon dioxide, Nutrients, Biological properties, Water pollution effects.
Identifiers: *Mass culture, *Algal growth, Chlorella pyrenoidosa (Emerson strain), Autoinhibitors.

Biological significance of the conditions affecting algal growth is discussed with special reference to Chlorella pyrenoidosa (Emerson strain). Consideration is given to the effect of controlled and measurable conditions, and these results are extrapolated to describe the characteristics of high-density cultures. The effect of light as a limiting factor is discussed also. In particular, growth rates are described as functions of (1) temperature, (2) light intensity, (3) concentration of carbon dioxide, (4) components of the nutrient medium, (5) autoinhibitors, and (6) characteristics of the organism. A specific growth rate of 1.96 per day is considered to be about the maximum rate for C pyrenoidosa and it is concluded that this value is not established by limitations of photosynthesis. (Uttormark-Wisc)
W69-07442

ON THE QUESTION OF THE EFFECT OF GROWTH DURING THE FIRST YEARS OF A FISH'S LIFE ON ITS SUBSEQUENT GROWTH,
D. F. Zamakhaev.
Trans from Tr Vses Nauch Issled Inst Morsk Rybn Khoz i Okeanogr Vol 50, pp 109-141, 1964. Fisheries Research Board of Canada Translation Series No 549, pp 1-39, 1965. 10 fig, 11 tab, 85 ref.

Descriptors: *Growth rates, *Fish, Age, Fish populations, Herrings.
Identifiers: *Lee's phenomenon, *Early growth, *Growth compensation, Caspian shad, Russia, Russian literature, Russian fisheries research, Zander.

Growth during the first year of fishes life has a strong influence on growth during subsequent years. Subsequent years growth is positively correlated with first-year growth, although the effect diminishes with the increasing age of the fish. In many species of fish, rapid first-year growth leads to earlier maturity, and, apparently, earlier physiological senility. An extensive review of the Russian literature regarding the relations between Lee's phenomenon, growth compens and first-year growth is given; Western litera (through 1957) is also reviewed. Tabular graphical data on observed and calculated gr are primarily from Russian sources. (Voigtla Wisc)
W69-07443

WATER POLLUTION ASPECTS OF UR RUNOFF; THE CAUSES AND REMEDIES WATER POLLUTION FROM SURF DRAINAGE OF URBAN AREAS.
American Public Works Association, Chicag Research Foundation.
For primary bibliographic entry see Field 05B
W69-07453

THE EFFECT OF INORGANIC SEDIMENT STREAM BIOTA,
DePauw Univ., Greencastle, Ind.
James R. Gammon.
Progress Report 1968. 84 p, 18 fig, 30 tab, 22 r

Descriptors: Industrial wastes, Qua Limestone, Sediments, Sediment yield, *Wate lution effects, Stream pollution, *Standing *Sedimentation rates, Benthic fauna, Density, population, Indiana, Pollution abatement.
Identifiers: Stonedust pollution, Diversity ind Population density, Macroinvertebrates.

Large quantities of sediment are carried to oc annually, complicating water treatment, redu recreation values of water and shortening reser life. Massive amounts of sediment also seri damages aquatic life, but quantitative studies lacking. Populations of fish in pools and mac vertebrates in riffles of a small stream were stu in relation to a crushed-rock quarry. In 1967 33,600 kg of stonedust entered the stream fro quarry, while in 1968 due to altered quarry o tions more than 4.8 million kg were produced standing crop of fish in two pools above the q averaged 400 kg/ha. The average standing crop pools below the quarry rose from only 200 kg/ June to 250 in August 1967 because of the ent numerous, small redhorse and longear sunfish creased amounts of suspended sediment red this to only 100 kg/ha in June 1968 and by tember, 2 pools were filled with sediment and tained no fish. Comparable changes were not the density of macroinvertebrate popula which nevertheless exhibited comparable div indices both above and below the quarry. Fe ganisms were tolerant to the sediment and a were notably intolerant, especially carpsucker gizzard shad.
W69-07455

MANAGEMENT OF WASTE HEAT FR THERMAL POWERPLANTS,
Tennessee Valley Authority, Chattanooga. P Research Staff.
C. J. Powell, and C. H. Waugaman.
Paper at American Public Power Association gineering and Operations Workshop, Feb. 1 1969, Robert Meyer Hotel, Jacksonville, Fla.

Descriptors: Thermal pollution, *Water poll control, Temperature control, *Tennessee V Authority Project, Powerplants, Water temp ture, Zooplankton, Aquatic organisms, Aq life, *Fish conservation, Pollution abate Aquatic plants.
Identifiers: *Waste heat management, *Water perature standards.

Water temperature standards being adopted u the Water Pollution Control Act constitute a constraint in the design and operation of st electric generating plants. The TVA has condu at its Paradise Plant in Kentucky five research jects to determine the effects of increased w temperature on aquatic organisms; it is proje continued research at its Browns Ferry Nu

At Paradise the criterion was reduced to 90
average temperature and a maximum surface
:rature of 93 deg F. The principal means of
:al control of thermal discharges employed
kimmer walls, submerged dams, diffusers,
flow regulation, reduction of generation, and
ıg towers. (Mills-TVA)
07465

ATIC ENVIRONMENT AND FOOD
TS OF MAYFLIES,
Univ., Moscow.
Brusven, and B. R. Gilpin.
ıical Completion Report OWRR Project A-
DA, June 1969. 86 p.

iptors: *Mayflies, *Food habits, *Ecology,
ms, Behavior, Distribution.

ood habits and ecology were studied for 31
:s of mayfly nymphs from the St. Maries River
ıho, during 1967 and 1968. Mayfly nymphs
basically herbivores feeding on variable
nts of detritus, diatoms and filamentous algae;
ıs were occasionally consumed. The feeding
s depended largely on the microhabitat of the
h. e.g. riffle species generally fed more on
entous algae and diatoms while pool-inhabit-
ymphs fed largely on detritus. Different age
:s of nymphs usually fed on the same relative
osition of food. Nymphs of many mayfly spe-
demonstrated similar microhabitat affinities,
ugh the macrohabitats were often dissimilar.
m type and current speed were important fac-
limiting mayfly distribution. A dendrogram
sed to correlate station similarities biotically;
al diverse habitats supported the same spe-
(Warwick-Idaho Univ)
07472

OSAL OF THE EFFLUENTS FROM
ALINATION PLANTS: THE EFFECTS OF
PER CONTENT, HEAT AND SALINITY,
Chemical Co., Freeport, Tex.
Zeitoun, E. F. Mandelli, W. F. McIlhenny,
. O. Reid.
e of Saline Water, Research and Development
ess Report No. 437, March 1969. 192 p.
-14-01-0001-1161.

iptors: *Brine disposal, *Brines, *Saline
, *Water pollution, Waste disposal, *Thermal
ion, Effluents, Outlets, Desalination.
ifiers: *Marine ecology, *Effluent dispersion,
per removal, Diffusers.

ria for outfall designs were established based
e copper concentration in the effluent from a
ing plant, its concentration after dispersion in
nvironment and the ecological effects of heat,
y and copper on the planktonic organisms in
ater column. The copper introduced into the
from existing distillation plants averaged
0.34 to 0.65 mg/l. Copper was found to be
soluble in sea water concentrates than in sea
, with a minimum solubility at pH 7.5. The
val of copper from brine blowdown by plating
uminum was found to be technically unfeasi-
ue to side reactions involving evolution of
gen. The removal of of copper on Dowex A-1
ing resin was found to be an efficient process,
ie estimated cost would be 4.2 cents/1000 gal-
or a 1.5 MGD plant. The use of diffusers to
ie effluent with sea water to reach safe copper
ntration by dilution is believed to be a more
ical solution than chemical removal or inac-
on. (Gransee Office of Saline Water)
07476

OSAL OF THE EFFLUENTS FROM
ALINATION PLANTS INTO ESTUARINE
ERS,
Chemical Co., Freeport, Tex.
Zeitoun, E. F. Mandelli, and W. F.
lenny.
Office of Saline Water, Research and Development Progress Report No. 415, March 1969. 140 p. OSW-14-01-0001-1161.

Descriptors: *Brine disposal, *Brines, Estuaries, *Saline water, *Thermal pollution, Waste disposal, Effluents, Desalination.
Identifiers: *Marine ecology, *Biological effects, Hydrology.

Trends in the development of saline water conversion systems are reviewed. Effluent quantities and characteristics produced by the plants of various sizes and types are evaluated. The hydraulics of the estuary are described and related to the size and type of desalination plant. Biological effects of waste brines on the estuarine resources are discussed. The disposal of effluents from desalination plants into estuarine waters can produce changes in the temperature, salinity, copper concentration, oxygen content, hardness and other minor parameters of the environment. The proper design of an outfall system will minimize environmental changes. Pretreatments that may be found necessary before introduction of the effluent into the receiving estuary are aeration to increase its content of dissolved oxygen or copper removal. (Gransee Office of Saline Water)
W69-07477

EUTROPHICATION--A REVIEW,
Wisconsin Univ., Madison. Water Resources Center.
Kenton M. Stewart, and Gerard A. Rohlich.
Water Quality Control Board, California, Pub No 34, 188 pp, 1967. 4 fig, 611 ref.

Descriptors: *Bibliographies, *Eutrophication, *Reviews, *Water pollution control, *Water pollution effects, *Water pollution sources, Translations, Algicides, Bacteria, Benthos, Bioassay, Chlorophyll, Fertilization, Fish, Harvesting, Hydraulics, Lakes, Limnology, Nutrients, Optical properties, Oxygen, Plankton, Productivity, Radioisotopes, Radioactive dating, Sedimentation, Systematics, Silting, Thermal properties, Vegetation, Water chemistry, Water quality.
Identifiers: Asia, Australia, Case histories, Europe, Laboratory studies, North America, Residence time.

This retrospective critical review of eutrophication considers some 314 documents which are, authors imply, key references bearing on the problem. In addition to study of the diverse literature, they discussed subject with investigators at home and abroad, and the resulting discussions are incorporated into corpus of review. Incorporating material on botany, zoology, limnology, agricultural engineering and areas related to eutrophication, the organization of the report is indicated by its section headings: Introduction; definitions of eutrophication, production, productivity, and blooms; trophic typology of lakes; physical considerations including climate, morphometry, thermal properties, optical properties, hydromechanics, residence time, siltation and sedimentation; nutrient considerations including field and laboratory studies; biological considerations including taxonomy, plankton, fish and bacteria; fertilization studies including examples and research techniques; a variety of case histories, both domestic and foreign; a variety of indices for measuring eutrophication; natural and developmental origin of nutrients and their quantities; desirable and undesirable effects of eutrophication; current methods for prevention and control including land use, effluent diversion, dredging, roughfish harvest, plant harvest, low-flow augmentation, algicides, and nutrient removal from waste waters; and research needs. Report includes a second bibliography to augment literature cited, and appendices of serial titles, conversion factors, and glossary. (Eichhorn-Wisc)
W69-07480

EFFECTS OF HEATED DISCHARGE UPON AQUATIC RESOURCES OF WHITE RIVER AT PETERSBURG,
Indiana Univ., Bloomington. Dept. of Life Sciences.
Max A. Proffitt.
Ind Univ Water Resources Res Center Rep of Invest No 3, Feb 1969. 101 p, 9 fig, 4 plate, 21 tab, 10 ref.

Descriptors: *Thermal pollution, *Heated water, *Thermal powerplants, *Indiana, Water temperature, Biology, Dissolved oxygen, Water chemistry, Water quality, Water pollution effects.
Identifiers: White River (Ind), Petersburg (Ind).

A field study was made of the physical, chemical and biological effects of heated water discharges on the White River at Petersburg, Indiana. The discharge water is about 18-20 deg F warmer than the ambient water temperature and is at times as much as 1/4 of the total river flow. Mixing is complete within 1 mile, and the mixed water temperature is never over 5 deg F warmer than upstream temperatures. The average warming is about 1/2 deg F. Oxygen is not depressed significantly. Negative effects on life are confined to the effluent canal, and some fishes and invertebrates are more abundant in the heated water. The highest recorded river temperature was 107 1/2 deg F. (Knapp-USGS)
W69-07494

FACTORS INITIATING PHYTOPLANKTON BLOOMS AND RESULTING EFFECTS ON DISSOLVED OXYGEN IN DUWAMISH RIVER ESTUARY, SEATTLE, WASHINGTON,
Geological Survey, Washington, D. C.
Eugene Welch.
Geol Surv Water-Supply Pap 1873-A, 1969. 62 p, 22 fig, 5 tab, 45 ref.

Descriptors: *Phytoplankton, *Eutrophication, *Washington, *Estuaries, Aquatic productivity, Nutrients, Oxygen, Plankton, Biochemical oxygen demand, Water circulation, Hydraulics, Currents (Water), Tides.
Identifiers: *Phytoplankton blooms, *Seattle (Wash), Duwamish River.

Phytoplankton productivity, standing stock, and related environmental factors were studied during 1964-66 in the Duwamish River estuary, at Seattle, Wash., to ascertain the factors that affect phytoplankton growth in the estuary. Phytoplankton blooms, primarily of diatoms, occurred in the lower estuary during August 1965 and 1966. No bloom occurred during 1964, but the presence of oxygen-supersaturated surface water in August 1963 indicates that a bloom did occur then. Nutrients probably were not the primary factor controlling the timing of phytoplankton blooms. The consistent coincidence of blooms with minimum fresh-water discharge and tidal exchange during August throughout the study period indicates that bloom timing probably was controlled mostly by hydrographic factors that determine retention time and stability of the surface-water layer. This control was demonstrated in part by a highly significant correlation of gross productivity with retention time and stability of the surface-water layer. This control was demonstrated in part by a highly significant correlation of gross productivity with retention time (as indicated by fresh-water discharge) and vertical stability (as indicated by the difference between mean surface and mean bottom temperatures). The highly significant correlation of chlorophyll (a) with BOD throughout the summer indicates that respiration and decomposition of phytoplankton cells is clearly an important contributor of BOD. A green algal population in vitro did increase in response to added effluents nutrients; however, the available field data suggest that a 46% increase in effluent discharge between 1965 and 1966 did not increase the estuary's phytoplankton biomass significantly. (Knapp-USGS)
W69-07507

LIBRARY U. OF I., URBANA-CHAMPAIGN

PREDICTING DISSOLVED OXYGEN VARIATIONS CAUSED BY ALGAE,
Federal Water Pollution Control Administration, Alameda, Calif. Central Pacific River Basins Project.
Richard C. Bain, Jr.
ASCE Proc, J Sanit Eng Div, Vol 94, No SA5, Pap 6155, pp 867-881, Oct 1968. 15 p, 8 fig, 2 tab, 26 ref, append.

Descriptors: *Dissolved oxygen, *Algae, *Respiration, *Estuaries, *Eutrophication, *California, Water pollution, Reaeration, Nutrients, Oxygen sag, Aeration, Biochemical oxygen demand, Photosynthetic oxygen.
Identifiers: Streeter-Phelps equation, Dissolved oxygen variations, San Joaquin River, Potomac estuary, San Francisco Bay.

Eutrophic environments are often dominated by planktonic algal populations (phytoplankton) which cause diurnal variations in DO concentrations through respiratory activity and photosynthesis. Photosynthetic oxygenation and respiratory deoxygenation rates of estuarine phytoplankton were measured at various standing crop (chlorophyll) levels. Oxygen production and consumption rates for actively growing phytoplankton populations were related to standing crop at 20 deg C and non-limiting light. Variations in algal photosynthetic production rate, as related to light adaption, age of cells, nutrition, temperature and algal type, are considered. The Streeter-Phelps equation was modified to include phytoplankton production and respiration rates in formulations designed to predict DO concentrations over a 24-hr period. An example is given, and the resulting predictions are compared with field measurements from a tidal reach of the San Joaquin River, California. (Knapp-USGS)
W69-07520

CITY OF COLUMBIA V LENTZ (OVERFLOW OF MUNICIPAL SEWAGE SYSTEM).

282 SW 2d 787-793 (Tenn Ct App 1955).

Descriptors: *Tennessee, *Sewage disposal, *Water pollution sources, *Municipal wastes, Pipelines, Cities, Water pollution effects, Impaired water quality, Manholes, Pollutants, Sewage effluents, Legal aspects, Judicial decisions, Damages, Overflow.
Identifiers: Nuisance (Private), Evidence.

Plaintiffs brought this action to recover damages for an alleged nuisance caused by discharge of raw sewage from manholes along defendant city's sewer pipeline onto plaintiffs' farmland and into a creek. Plaintiffs' evidence showed that defendant's sewer line periodically overflowed onto their field and into a creek, permitting raw sewerage to accumulate which gave off foul and noxious odors, polluted the water in the creek, impaired the value of their farm, and rendered plaintiffs' home almost uninhabitable. The court of appeals held that the evidence was sufficient to support the nuisance allegation and the amount of damages recovered. The court noted that such accumulation of effluents and filth constituted actionable nuisance at common law and under the Tennessee statute. It also held that deeds conveying the right of way for the sewer did not give the city the right to overflow sewage through the manholes upon plaintiffs' land, and hence constituted no defense to the action. (Carruthers-Fla)
W69-07635

5D. Waste Treatment Processes

SEWAGE TREATMENT.
For primary bibliographic entry see Field 06E.
W69-07279

WATER SUPPLY AND WATER RECLAMATION FOR NEW DALLAS-FORT WORTH REGIONAL AIRPORT,
Tippetts-Abbett-McCarthy-Stratton, New York.
Edward A. Bryant, and John F. Lenard.
J Water Pollut Contr Federation, Vol 41, No 5, Part 1, pp 772-784, May 1969. 13 p, 5 fig, 8 tab, 10 ref.

Descriptors: *Water reuse, *Airports, Industrial wastes, Water supply, Activated sludge, Lagoons, Sewage treatment, Irrigation water, Waste water disposal.
Identifiers: Dallas (Tex), Fort Worth (Tex).

Engineers have the opportunity at the New Dallas-Fort Worth Regional Airport to recommend a water and wastewater design which is not compromised by existing facilities. After a preliminary study of 13 representative airports, it was decided to provide an average water demand (1975) of 5 mgd (18,900 cu m/day) for the facility--equivalent to a city of 50,000 people. Because of the lack of nearby receiving waters, reuse of wastewaters is planned. The diversity of the waste (from the cleaning of planes and parts, and from domestic, restaurant, and other miscellaneous operations) and the recirculation uses (air-conditioning make-up, irrigation) makes the design problem involved. A special industrial wastes pretreatment scheme for oil separation and neutralization followed by activated sludge and lagooning is planned. (Knapp-USGS)
W69-07360

A MATHEMATICAL MODEL FOR THE CONTINUOUS CULTURE OF MICROORGANISMS UTILIZING INHIBITORY SUBSTRATES,
Clemson Univ., S.C. Environmental Systems Engineering.
John F. Andrews.
Biotechnology and Bioengineering, Vol X, Issue 6, pp 707-723, 1968. 10 fig, 12 ref.

Descriptors: *Mathematical models, *Microorganisms, *Kinetics, Growth rates, Cultures, Biological treatment, Waste treatment, Eutrophication, Water pollution effects.
Identifiers: *Continuous culture, *Inhibitory substrates, Growth kinetics, Batch cultures, Growth inhibition, Substrate-limited growth.

A mathematical model is presented describing the kinetics for both batch and continuous culture of microorganisms utilizing substances which limit growth at low concentrations and inhibit growth at higher concentrations. A key feature of the model is the use of an inhibition function (after Haldane) which relates substrate concentration to specific growth rate. A digital computer was used in simulation studies and it is shown that the primary result of inhibition by substrate in a batch culture is an increase in the lag time, whereas in continuous culture process instability may result. The model is also used to illustrate how process failure may occur during start-up of continuous-flow biological processes as a result of inhibition. The model should be of value in investigations of the stability of biological processes used for the treatment of certain industrial wastes which are known to be inhibitory to many of the organisms metabolizing them. (Uttormark-Wisc)
W69-07439

ABATEMENT OF POLLUTION FROM MINE WASTEWATERS,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 05B.
W69-07490

DYNAMIC OPTIMIZATION FOR INDUSTRIAL WASTE TREATMENT DESIGN,
Weston (Roy F.), Inc., West Chester, Pa.
Chia Shun Shih, and P. Krishnan.
Pap, 24th Annu Purdue Ind Waste Conf, Lafayette, May 6-8, 1969. 18 p, 8 fig, 14 tab.

Descriptors: *Dynamic programming, *Waste water treatment, *Industrial wastes, *Design, Optimization, Decision making, Sequence, Annual costs, Comparative costs.
Identifiers: Multistage treatment sequence.

Dynamic programming was used for the syste
timization (cost minimization) of an indu
waste water treatment design. The optimiz
procedure for a serial multistage system with
point boundary value was utilized. The object
the optimization was to identify the least cost
binations and efficiences of various unit proc
in a multistage treatment plant required to m
ultimate water quality standard. After princip
dynamic programming were briefly reviewe
economic optimization scheme for the wast
treatment plant design was formulated. A sp
case in pulp and paper waste water treatment
cost functions based on process design an
gineering evaluations, illustrated the use o
technique. It was concluded that the 'Decisi
version Method' of dynamic programming co
integrated into a design procedure for indu
waste treatment, but that further research in
interdependency between treatment processe
required. (Gysi-Cornell)
W69-07555

**THE USE OF OPERATIONS RESEA
TECHNIQUES IN WASTEWATER TR
MENT PLANT DESIGN,**
North Carolina State Univ., Raleigh.
William S. Galler.
Proc, Nat Symp Anal Water-Resource Sys
225-230, July 1-3, 1968. 6 p, 17 ref.

Descriptors: *Operations research, *Waste
treatment, *Design, Evaluation, Mathem
models, Biological oxygen demand, Optimiz
Activated sludge, Stochastic processes, Biol
treatment.

The application of operations research techn
to the formulation of wastewater treatment
design was discussed. The objective of the
was the evaluation of design formulations de
by various individuals for water treatment pla
was stated that research on the optimal des
waste treatment plants had progressed dow
paths. One path followed the treatment plan
timization route in which the total cost of the
as a whole was minimized. Research alon
other path was aimed at determining design cr
for the optimization of unit processes. For the
method, the biological filter and the acti
sludge processes had been investigated.
minimizing total plant cost both stochastic
deterministic mathematical models were us
determine the rate of BDD reduction requir
was concluded that consideration had to be
to the integrated system. One part of the s
could not be optimized by itself. All parts had
considered together. For main entry see
07562. (Thiuri-Cornell)
W69-07575

5E. Ultimate Disposal of Wastes

**HYDROGEOLOGIC CONSIDERATIONS
LIQUID WASTE DISPOSAL,**
Wisconsin Univ., Madison. Dept. of Geology.
S. M. Born, and D. A. Stephenson.
J Soil and Water Conserv, Vol 24, No 2, pp 5
Mar-Apr 1969. 4 p, 2 fig, 7 ref.

Descriptors: *Waste water disposal, *Irrig
*Sprinkler irrigation, Hydrogeology, Soils, P
ty, Permeability, Groundwater movement,
water movement, Infiltration, Percolation, Ac
tion, Filtration.
Identifiers: Spray disposal.

The geohydrology of liquid waste disposal by i
tion is reviewed. Knowledge of geologic cond
is necessary for spray irrigation disposal of w
The thickness, nature, and distribution of u
solidated surface deposits determine infiltr
adsorption storage, and downward moveme
waste water. Infiltrometer tests may be used i
or laboratory examination of samples can
quicker less accurate information. The condit

rock determines rate of water movement and ctiveness of filtration. Flow systems must be lied to learn where wastes will travel. (Knapp-GS)
9-07375

OPHYSICAL AND GEOLOGICAL STUDIES THE RELATIONSHIPS BETWEEN THE NVER EARTHQUAKES AND THE ROCKY UNTAIN ARSENAL WELL, PART A,
orado School of Mines, Golden. Dept. of physics; and Colorado School of Mines, Gol-. Dept. of Geology.
primary bibliographic entry see Field 02F.
9-07410

OPERTIES OF THE ROCKY MOUNTAIN SENAL DISPOSAL RESERVOIR AND THEIR LATION TO DERBY EARTHQUAKES,
orado School of Mines, Golden. Dept. of physics.
primary bibliographic entry see Field 02F.
9-07411

DRAULIC CHARACTER OF FRACTURED TAMORPHIC ROCKS OF THE FRONT NGE AND IMPLICATIONS TO THE ROCKY UNTAIN ARSENAL WELL,
orado School of Mines, Golden. Dept. of logy.
primary bibliographic entry see Field 02F.
9-07412

ACTURE DEFORMATION AND CHANGES PERMEABILITY AND STORAGE UPON ANGES OF FLUID PRESSURE,
orado School of Mines, Golden. Dept. of logy.
primary bibliographic entry see Field 02F.
9-07413

DRODYNAMIC STUDY OF THE WESTERN NVER BASIN, COLORADO,
roleum Research Corp., Denver, Colo.
primary bibliographic entry see Field 02F.
9-07414

SPOSAL OF THE EFFLUENTS FROM SALINATION PLANTS: THE EFFECTS OF PPER CONTENT, HEAT AND SALINITY,
w Chemical Co., Freeport, Tex.
primary bibliographic entry see Field 05C.
9-07476

SPOSAL OF THE EFFLUENTS FROM SALINATION PLANTS INTO ESTUARINE ATERS,
w Chemical Co., Freeport, Tex.
primary bibliographic entry see Field 05C.
9-07477

SIGN OF SEWER SYSTEMS,
orado State Univ., Fort Collins.
primary bibliographic entry see Field 08B.
9-07574

E DEPOSIT OF REFUSE IN N Y HARBOR D ADJACENT WATERS IS PROHIBITED.
primary bibliographic entry see Field 05G.
9-07657

'. Water Treatment and Quality Alteration

VELOPMENT OF METHODS FOR CONOLLING THE COPPER CONTENT IN ATER,
ode Island Univ., Kingston. Water Resources ater.
Kenneth H. Mairs.
Completion Report OWRR Project A-014-RI, 1968. 10 p.

Descriptors: *Corrosion control, *Inhibition, *Copper, *Limestone.
Identifiers: *Mineralization, *Soft water, *Well water.

This project had two major objectives: (1) to study the means by which copper becomes soluble in water and (2) to devise means or methods by which soluble copper could be controlled or reduced to acceptable limits. The overall reaction for corrosion of copper in mildly acid solution has been demonstrated to be: 2 Cuz 2Hzz 1/2 02x 2 Cuzz H2O. In order for this reaction to proceed, the water must be acidic and contain oxygen. This condition is found in many soft, natural waters. To limit the copper content, one must either destroy the aggressiveness or remove the copper as the water is used. Obviously the first approach is more desirable. A neutralizing filter proved to be a simple effective inexpensive control device. Basically, this filter is a deep bed of limestone chips which reacts with and reduces the free carbon dioxide content of raw water. While corrosion and soluble copper is effectively controlled, the bicarbonate hardness and pH are increased appreciable. (Rose-Rhode Island Univ)
W69-07471

OPTIMUM DESIGN OF WATER FILTRATION PLANTS,
Iowa State Univ., Ames. Engineering Research Inst.
E. Robert Baumann.
Proc, Nat Symp Anal Wat r-Resource Syst, pp 195-217, Denver, July 1-3, 1968. 25 p, 8 fig, 8 tab, 14 ref.

Descriptors: *Hydraulic design, *Filtration, *Optimization, *Mathematical models, Timing, Correlation analysis, Digital computers, Water supply, Economic efficiency, Design, Head loss, Water quality, Water treatment.
Identifiers: *Diatomite filters, Gilter cakes.

A 'Program for Optimization of Plant Operation', (POPO) was described for the design of diatomite filtration plants for operation at least cost. Mathematical models were developed to predict head-loss time relationships for a diatomite filter under varying operating conditions. Filter cake resistance coefficients were collected and correlated to measurable filtration variables. Through the use of a computer program the cost combinations of filtration designs were specified. It was found that the POPO has potential in the determination of least cost combinations of water filtration design and operating parameters. The size of the plant was found to have significant effects on the minimum cost. Optimum filtration rate increased with plant size. For main entry see W69-07562. (Thiuri-Cornell)
W69-07573

RAW-WATER QUALITY CRITERIA FOR PUBLIC SUPPLIES,
Robert J. Becker, Elwood L. Bean, Byron Beattie, H. H. Budd, and Richard L. Woodward.
Journal of American Water Works Association, Vol 61, No 3, pp 133-138, Mar 1969. 6 p, 10 ref, 2 tab.

Descriptors: *Water quality, *Standards, *Water quality control, *Supply, Water, Color, Color reactions, Odor, Water temperature, Turbidity, Coliforms, Alkalinity, Ammonia, Inorganic compounds, Metals, Boron, Salts, Dissolved oxygen, Fluorides, Hardness (Water), Nitrites, Nitrates, Hydrogen ion concentration, Phosphorus, Dissolved solids, Pesticides.

Criteria for the concentration of various substances which affect raw-water quality are set forth. The criteria are set for considered treatment processes which were thought most commonly used nationwide: coagulation, sedimentation, sand filtration and disinfection with chlorine. The report discusses, in limited detail, the subcommittee's findings as to desirable criteria relating to eighteen classifications of substances. There are two levels of criteria. Permissible criteria are those characteristics and concentrations of substances in raw water which will permit the production of acceptable public water after treatment by one or more of the methods set forth above. Desirable criteria are those characteristics and concentrations of substances which represent high-quality water in all respects. The criteria set forth in the report are to be used with substantial discretion because of the great regional variations in raw water quality. (Blunt-Fla)
W69-07578

DISPOSAL OF SEWAGE.
For primary bibliographic entry see Field 05G.
W69-07599

5G. Water Quality Control

SEWAGE TREATMENT.
For primary bibliographic entry see Field 06E.
W69-07279

WATER POLLUTION CONTROL.
W Va Code Ann sec 20-5A-17 through 20-5A-24 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Water pollution control, *Administrative agencies, *Abatement, Legislation, Regulation, Water pollution, Water pollution sources, Permits, Local governments, Jurisdiction, Water pollution effects, Fishkill, Aquatic life, Natural resources.
Identifiers: *Criminal law, Injunctions (Mandatory), Injunctions (Prohibitory).

The chief of the division of water resources may apply to the circuit court for the abatement of any water pollution which he deems a nuisance. Application shall be made to the circuit court of the county where the alleged water pollution is occurring. In cases of aggravated pollution where irreparable harm will result from any delay, the chief may apply for an immediate temporary injunction. Any person who fails to discharge any duty imposed on him by law or order of the chief is guilty of a misdemeanor. If such failure to obey any duty causes loss of game-fish or aquatic life, the state department of natural resources shall bring action to recover a sum equal to the cost of replacement. There is no criminal liability for a violation caused by an act of God, war, riot, or catastrophe which is not caused by negligence or wilful misconduct. If any provision of this article is invalid, such invalidity shall not affect the other provisions of the article. (Stewart-Fla)
W69-07281

POLLUTION ABATEMENT (POWERS AND DUTIES OF DEPARTMENT OF WATER RESOURCES).

Md Ann Code, Art 96A:23-29 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Water pollution control, *Water quality control, *Pollution abatement, Water pollution, Water quality, Treatment facilities, Legislation, Water pollution treatment, Water resources development, Administrative agencies, Coordination, Planning, Regulation, Remedies, Legal aspects, Water users, Project planning, Water control, Oil, Oil wastes, Appropriation, Competing uses.
Identifiers: Penalties (Criminal), Injunctions.

The Maryland Department of Water Resources has the duty to study and recommend means of pollution abatement, and the Department may encourage voluntary cooperation among competing

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interests. The Department may enforce and assist other agencies in enforcing existing pollution laws. It shall also be authorized to conduct research and develop additional information on pollution. The Department may receive complaints, conduct hearings upon proper notice, and issue orders directing persons causing pollution to secure specified results; if such results are not secured, the person may be directed to install proper and practicable treatment facilities. The Department may also review and make recommendations to other state agencies which may be causing pollution. In addition, the agency may establish reasonable water quality standards. The Department has the right of entry upon any property, and the duty to periodically review appropriation permits. Criminal penalties and injunctions are available to the agency to insure compliance with the act's provisions. Specific enforcement provisions have been made applicable to oil discharge. (Wheeler-Fla)
W69-07284

NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMMISSION.

Conn Gen Stat Ann sec 25-67, 25-68 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *New England Interstate WPS Compact, *Water pollution control, *Pollution abatement, Interstate compacts, Interstate commissions, Legislation, Water law, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, Interstate rivers, Planning, Financing.
Identifiers: *Interstate waters, Water classification.

The New England Interstate Water Pollution Control Commission is composed of the Commissioner of Health, the Director of the Water Resources Commission, and the governors of three signatory states. The purpose of the pollution control compact between Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont is to abate the pollution of interstate waters. The compact provisions apply to all waters contiguous to two or more signatory states. There are to be 5 commissioners from each state and a majority of the 5 must approve any action obligatory upon the state. THhe commission may recommend legislative action to carry out the purpose of the compact, but it may not pledge the credit of any signatory state. The commission will impose no single standard of water quality; however, each state is called upon to submit classifications of use for their interstate waters from which the commission will recommend standards for water classification. Each state agrees to abate and control pollution consistent with the classified use of each body of water. Costs of administration are to be proportionately borne by the signatory states. The commission may enter into agreements with New York concerning pollution abatement. (Holt-Fla)
W69-07287

WATER POLLUTION CONTROL.

Conn Gen Stat Ann 25-54a through 25-54aa (Supp 1968).

Descriptors: *Connecticut, *Water pollution control, *Administrative agencies, *State governments, Streams, Water resources development, Water conservation, Water supply, Water utilization, Condemnation, Eminent domain, Water harvesting, Subsurface waters, Surface waters, Public benefits, Public health, Public rights, Wastes, Pollution abatement, Legal aspects, Potable water, Water quality, Water users, Hydraulic structures, Legislation.

Water pollution is recognized by statute to be inimical to public health. The Water Resources Commission was created to prevent future pollution and to abate existing pollution of a thermal or chemical nature. The Commission is charged with development of comprehensive anti-pollution programs. The Commission is to require submission of plans and specifications for the construction or modification of pollution abatement facilities. Standards of water quality applicable to the various waters of the state shall be adopted by the Commission in order to further public welfare and to conserve wildlife. These standards shall be consistent with those established by the Board of Health and shall not be adopted in final form without undergoing the scrutiny of a public hearing. The Commission may order any municipality to cease and desist from polluting public waters. After 1 May 1967, a permit shall be required before any person may discharge water or material into state waters. Persons discharging substances into state waters prior to this date may substantially change the volume or flow thereof. The Commission may make a grant to any municipality which constructs or rebuilds a pollution abatement facility. (Katz-Fla)
W69-07288

WATER POLLUTION CONTROL.
Conn Gen Stat Ann sec 25-54a to 25-54d (Supp 1968).

Descriptors: *Connecticut, *Administrative agencies, *State governments, Legislation, Streams, Water resources development, Water conservation, Water supply, Water utilization, Condemnation, Eminent domain, Water harvesting, Subsurface waters, Surface waters, Public benefits, Public health, Public rights, Wastes, Water pollution control, Pollution abatement, Legal aspects, Potable water, Water quality, Water users, Hydraulic structures, Sewage disposal, Project planning, Permits, Administrative decisions.

The Water Resources Commission is charged with the general supervision and administration of this statute. The Commission shall develop comprehensive programs for the prevention, control and abatement of existing pollution of state waters. The responsibility for coordination of water policy objectives between local, state and federal agencies rests with the Commission. Studies, investigations and demonstrations concerning water pollution shall be conducted by the Commission. The Commission may issue, modify or revoke orders regarding the abatement of water pollution. All plans and specifications for modification or construction of disposal systems or pollution abatement systems must be submitted to the Commission. Upon approval of such plans, a permit will be issued authorizing the proponent to proceed. The Commission is granted the power to exercise all incidental powers necessary to carry out the purposes of this provision. (Katz-Fla)
W69-07289

WATER POLLUTION CONTROL.
Conn Gen Stat Ann sec 25-54e to 25-54aa (Supp 1968).

Descriptors: *Connecticut, *Administrative agencies, *State governments, Legislation, Streams, Water resources development, Water conservation, Water supply, Water utilization, Condemnation, Eminent domain, Water harvesting, Subsurface waters, Surface waters, Public benefits, Public health, Public rights, Legal aspects, Potable water, Water quality, Water users, Hydraulic structures, Standards, Cost sharing, Wastes, Water pollution control, Pollution abatement.

The Commission shall adopt standards of water quality applicable to various state waters. These standards shall at least conform with the Federal Water Pollution Control Act. Such standards shall not sanction the discharge of untreated sewerage into state waters under any circumstances. These standards shall apply to all intrastate and interstate waters as designated by the Commission. Prior to adoption of any water quality standard, the Commission must conduct a public hearing. Adequate notice of the hearing and of the proposed quality standard is required. The Commission may issue an abatement order to any municipality which is ing pollution of state waters. Any munici which constructs or acquires a pollution abate facility may receive a grant from the Comm equal to thirty per cent of the cost of such fa The Water Resources Commission may a available federal aid. Provisions are set providing for advancements of state funds t nicipalities in anticipation of receipt of fe funds for pollution abatement facility constru (Katz-Fla)
W69-07290

WATER POLLUTION CONTROL; SANIT DISTRICTS WATER POLLUTION CONT ACT.
Minn Stat Ann secs 115.01 to 115.09 (1964).

Descriptors: *Minnesota, *Water pollution trol, *Permits, *Legal aspects, Sewage, Indu wastes, Disposal, State governments, Se disposal, Legislation, Administrative age Planning, Standards, Investigations, Poll abatement, Sanitary engineering, Adjudic procedure.
Identifiers: *Interstate cooperation, *Legal ministration, *Appeal of administrative or *Evidence, Nuisances (Public).

The commission is empowered to investigate p tion, order discontinuance of waste discharge, disposal permits, hold hearings, issue subpo examine witnesses, administer oaths, have acc public and private property, and examine rec No final order of the commission shall affect v rights without notice and hearing. Appeal as in trials may be had with the appellant and con sion being parties. The state may interven record of the decision appealed from shall be r available. The action and findings of the con sion shall be prima facie reasonable and valid, the burden of proof upon the appellant. The mission may cooperate with other states, United States or Canada, relating to water p tion control, and may receive money from source for use in water pollution control. It lawful to construct, operate, or extend a dis system without a written permit. Permits shall sued to presently operating systems, subjec modification or revocation. Pollution may b joined as a public nuisance. (Harris-Fla)
W69-07294

POLLUTION CONTROL AGENCY.

Minn Stat Ann secs 116.01 to 116.09 (Supp 19

Descriptors: *Minnesota, *Water pollution trol, *Administrative agencies, *Pollution a ment, Land use, Solid wastes, Interstate, Wate rification, Legislation, Federal government, vestigations, Planning, Standards, State go ments, Public benefits.
Identifiers: *Minnesota Pollution Control Age

To achieve water purity in the public intere pollution control agency is hereby establishe successor to the water pollution control com sion, and shall be organized with seven mem (terms and selection detailed). The director be appointed to a term coincident to the g nor's. The governor may replace directors a pleasure. The agency is authorized to coope with other agencies and with state and fe governments in the public interest. The agen empowered to adopt standards of air quality otherwise control air pollution. The agency study and investigate problems of solid waste trol and land use in areas affected by air and w pollution and shall make reports and recomme tions to the governor and legislature. Recom dations may include comprehensive control abatement plans, and land use standards. (Ha Fla)
W69-07295

NKS V TOWN OF BURNSVILLE (SUIT TO OIN CITY FROM EMPTYING SEWAGE O STREAM).

N C 553, 46 SE 2d 559-561 (1948).

criptors: *North Carolina, *Potable water, unicipal wastes, *Water pollution, Pollution tement, Public health, Sewage, Waste disposal, er supply, Cities, Streams, Riparian land, Judi- decisions, Legal aspects.
ntifiers: Demurrer.

ntiffs brought suit to enjoin defendant mu- pality from emptying sewage into a slow ning stream. Following a showing that defen- t was in fact disposing of sewage into the am, the trial court granted the injunction. On eal, the trial court was reversed. The appellate rt noted that plaintiffs did not allege that they ed land abutting upon or contiguous to this am, nor that the stream was used as a source for lic drinking water. Defendant's demurrer uld have been sustained. The court held that, re public drinking water is concerned, mu- pal activities may be enjoined at the insistence ny person. However, if no public drinking water ply is involved, the individual seeking relief t allege that he owns land adjacent to such am and that the acts complained of are such as constitute a nuisance causing irreparable age to him. Failure to allege the above men- ed elements was fatal to plaintiffs' cause. gan-Fla)
9-07307

AGLE V CITY OF EAST LIVERPOOL (SUIT R WASHOUT DAMAGES AND POLLUTION ATEMENT).

primary bibliographic entry see Field 06E.
9-07312

Y OF WEST FRANKFORT V FULLOP (SUIT ENJOIN DRILLING AND OPERATION OF S AND OIL WELLS).

2d 609, 129 NE 2d 682-688 (1955).

criptors: *Illinois, *Water pollution control, ning, *Drainage districts, Water supply, Oil s, Drilling, Water pollution, Public health, al governments, Potable water, Impaired water lity, Water quality control, Public benefits, Ju- al decisions, Pollution abatement, Pollutant tification, Cities, Remedies.
ntifiers: Injunctions (Prohibitory).

ntiff brought this suit to enjoin operation and ing of gas and oil wells within an area surround- a lake. The lake constituted the plaintiff city's er supply. The city passed an ordinance declar- the lake area to be a drainage basin and hibiting drilling or operation of oil wells. The ndants alleged that this was an unlawful taking roperty without due process of law. The court l that the city had statutory power to enact this nance and that the statute was not unconstitu- al. The police power to protect public water ply against pollution may be delegated to cities. plaintiff city's ordinance was held to be a valid rcise of the police power, and the injunctive re- against oil well pollution was deemed proper. court further held that when it was apparent pollution would follow drilling operations, in- ctive relief could be granted before defendants n started operations. (Kelly-Fla)
9-07322

WERS AND DRAINS.

primary bibliographic entry see Field 06E.
9-07327

GRADATION OF GAMMA-BHC IN SIMU- TED LAKE IMPOUNDMENTS AS AF- CTED BY AERATION,

consin Univ., Madison. Dept. of Soils.
Leo W. Newland, Gordon Chesters, and Gerhard B. Lee.
J Water Pollut Contr Federation, Vol 41, No 5, Part 2, pp R174-R188, May 1969. 15 p, 7 fig, 1 tab, 28 ref. OWRR Grant No B-016-WIS.

Descriptors: *Insecticides, *Biodegradation, *Lakes, Model studies, Anaerobic conditions, Anaerobic bacteria, Aerobic conditions, Aerobic bacteria, Dissolved oxygen, Gas chromatography.
Identifiers: Benzene hexachloride, Insecticide detoxification.

The degradation of gamma-BHC (a benzene hexachloride isomer) in simulated aerobic and anerobic lake impoundments was determined. Anerobic degradation was much more rapid than aerobic degradation. In the aerobic simulated lake impoundment, degradation of 15 percent of the added gamma-BHC occurred in 2,100 hr and the isomer alpha-BHC was formed as the degradation product. In the anerobic impoundment 90% of the added gamma-BHC was degraded in the 2,100 hr incubation period to the isomers alpha and delta-BHC. Because of the profound effect of oxygen on degradation rates and the apparent 'lag phase' of the reaction, it is concluded that the isomerization of gamma-BHC occurs by a biological mechanism. The isomerization leads to detoxification of the insecticide.
W69-07364

IRRIGATION AS A MENACE TO HEALTH IN CALIFORNIA: A NINETEENTH CENTURY VIEW,

California Univ., Davis. Dept. of Geography.
For primary bibliographic entry see Field 06B.
W69-07372

MINE WASTEWATER PROBLEMS IN EUROPE,

Pennsylvania Dept. of Mines and Mineral Industry, Harrisburg. Div. of Research and Development.
David R. Maneval.
Proc 22nd Ind Waste Conf, May 2-4, 1967, Part 2, Purdue Univ, pp 608-619, 1967. 12 p, 9 fig.

Descriptors: *Acid mine water, *Water pollution control, Waste water treatment, Injection wells, Drainage, Groundwater, Aquifers, Filtration, Industrial wastes, Municipal wastes, Sewage treatment.
Identifiers: *European mine-water practices.

The cooperative approach of managing the water resources and water quality of a watershed which seems to be gathering strength in the United Kingdom, the Netherlands, Belgium, and Germany has many economic advantages. In most of the countries there is extensive research going on in connection with water pollution problems associated with the coal industry. In some countries, some aspects of this research are far advanced over that in the United States. European experience, particularly in England, clearly indicates that well-coordinated research efforts in the mine drainage and preparation plant effluent field by personnel permanently assigned to such research is of great benefit to the industry and to water pollution efforts. Most of the countries are ahead of the United States in the abatement of pollution from coal-processing plants. Usually, requirements in Europe regarding the discharge of solids from such plants are more stringent than they are in Pennsylvania. More effort should be put forth to review the European literature in this field and to provide for a more continuing exchange of technical information between European and American experts. The joint treatment of domestic and industrial wastes, observed in Europe, is of considerable economic benefit. Efforts in this direction should be expanded as much as possible. (Knapp-USGS)
W69-07418

THE CONTROL OF ACID MINE DRAINAGE POLLUTION BY BIOCHEMICAL OXIDATION AND LIMESTONE NEUTRALIZATION TREATMENT,

National Coal Board, Rotherham (England). Div. of Mine Water Investigation.
H. Gordon Glover.
Proc 22nd Ind Waste Conf, May 2-4, 1967, Part 2, Purdue Univ, pp 823-847, 1967. 25 p, 11 fig, 3 tab, 59 ref.

Descriptors: *Acid mine water, *Water pollution control, *Biodegradation, Waste water treatment, Iron bacteria, Sulfur bacteria, Neutralization, Limestone, Sulfates, Iron, Acid bacteria, Acid streams.
Identifiers: Acid mine drainage treatment.

A new process for the purification of acid drainage from coal mining operations is described. Novel features include the biochemical oxidation of ferrous salts in acid solution and the application of mechanical attrition to limestone grit which is used for the chemical neutralization of the oxidized drainage. The new process will be most applicable to the more dilute acid drainages for which the conventional lime process is less suitable, and the costs of the new process, where applicable, are expected to be appreciably less than the costs of the lime process. (Knapp-USGS)
W69-07419

REAERATION MEASUREMENTS IN A EUTROPHIC STREAM,

Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
W. A. Glain, and A. J. McDonnell.
Proc 22nd Ind Waste Conf, May 2-4, 1967, Part 2, Purdue Univ, pp 1044-1058, 1967. 15 p, 7 fig, 5 tab, 13 ref, 2 append.

Descriptors: *Reaeration, *Water pollution, *Streamflow, Turbulence, Slopes, Velocity, Channel morphology, Biodegradation, Oxygen sag, Dissolved oxygen, Oxygenation, Waste assimilative capacity.
Identifiers: Reaeration of eutrophic streams.

Reaeration was studied in a eutrophic stream in Pennsylvania, and observations were compared with predictions made by standard methods. In most cases, predictions by the methods of Owens were too high, while those by Churchill's formula were too low. For the study reaches investigated, corrections to reaeration coefficients reduced estimates as much as 40%. For steam bed slope, velocity, and depth ranges of 1.7 to 4.5 ft/1000 ft, 0.3 to 1.1 fps, and 0.90 to 1.8 ft; respectively, the empirical equation of Churchill best defined observed variability but the isotropic turbulence formula of O'Connor and Dobbins most accurately predicted observed reaeration coefficients. (Knapp-USGS)
W69-07420

ECONOMICS OF INDUCED RIVER AERATION,

Rutgers - The State Univ., New Brunswick, N. J.
William Whipple, Jr.
ASME/AIChE Stream Pollution Abatement Conference June 12, 1969. 21 p, 4 fig, 2 tab, 9 ref.

Descriptors: *Water quality control, *Aeration, *Dissolved oxygen, *Reaeration, Organic loading, Water pollution, Biochemical oxygen demand, Oxygen sag, Economics, Water pollution effects, Stream pollution, Water quality, Oxygenation.
Identifiers: *Artificial river aeration, *Induced river aeration, Unrecorded pollution, Unrecorded organic loading, BOD concentration, BOD loading.

A demonstration grant and several research programs related to possibilities of adding to the dissolved oxygen of streams by artificial means, or induced river aeration, has been underway for several years. This paper summarizes the general conclusions and certain economic considerations, and will be followed by a more detailed report. It is shown that for small polluted rivers induced river

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aeration is an entirely practicable alternative to advanced waste treatment and is apt to be much less expensive. The procedures for measuring oxygen transfer rate in tanks and lagoons are not generally applicable to rivers. On rivers such as the Passaic River, the existence of large amounts of unrecorded man-made pollution makes it unrealistic to attempt to maintain high levels of dissolved oxygen by treatment above. Induced river aeration may be not only the most economical alternative but the only practicable means of achieving such goals. (Whipple-Rutgers)
W69-07446

WATER POLLUTION ASPECTS OF URBAN RUNOFF; THE CAUSES AND REMEDIES OF WATER POLLUTION FROM SURFACE DRAINAGE OF URBAN AREAS.
American Public Works Association, Chicago, Ill. Research Foundation.
For primary bibliographic entry see Field 05B.
W69-07453

WASTE DISPOSAL COSTS OF A FLORIDA PHOSPHATE OPERATION,
Bureau of Mines, Knoxville, Tenn. Knoxville Office of Mineral Resources.
J. R. Boyle.
Available from U. S. Gov't. Printing Office, Wash., D. C., for 35 cents.

Descriptors: Construction costs, Dam design, Earth dams, Environment, Flocculants, Hydraulic excavation, *Phosphates, *Pollution abatement, Research and development, Resource conservation, Slimes, *Waste disposal, Water conservation, *Water costs, Water management, *Water pollution source, Water recirculation.

The waste disposal method used at the International Minerals and Chemical Corporations's Noralyn Phosphate Operations in Polk County, Fla., was studied to develop cost estimates, provide better knowledge of current practices, guide consideration of alternative methods and identify possible areas of research. Cost estimates were based on capacities of existing facilities, but the phosphate production and slime generation statistics used in the calculations were estimates rather than data drawn from company records. Cost estimates represent a basis for calculating waste disposal costs for other phosphate plants which utilize the same method of disposal. Total operating cost of disposal is estimated to be 33.0 cents per ton of product based on an assumed 4.5 million tons of slime per year. Net operating cost is estimated to be 24.5 cents per ton of product after credit of 8.5 cents per ton for recirculated water from the settling ponds to the plant. To conserve mineral resources and to improve environmental conditions, research should be directed to developing alternative methods of disposal, including the recovery of the P2O5 values from the slimes and the dewatering of the slimes.
W69-07454

MANAGEMENT OF WASTE HEAT FROM THERMAL POWERPLANTS,
Tennessee Valley Authority, Chattanooga. Power Research Staff.
For primary bibliographic entry see Field 05C.
W69-07465

DESIGN OF DAMS FOR MILL TAILINGS,
Bureau of Mines, Washington, D. C.
C. D. Kealy, and R. L. Soderberg.
Bureau of Mines, Information Circular 8410, 1969. 49 p, 25 fig, 11 ref, 1 append.

Descriptors: *Waste disposal, *Mill dams, *Strip mine wastes, Earth dams, Surface drainage, Mine wastes, Permeability, Flow nets, Slope stability, Hydraulic gradient, Phreatic line, Dam failure, Safety factor, Seepage, Computer programs.

The Bureau of Mines studied tailings disposal problems at mines throughout the United States to identify design principles that can be applied to all types of dams for mill trailings. Computer programs for stability analysis and phreatic waterline estimation are also reviewed in this circular, which presents the Bureau's recommendations for constructing effective, long-lasting tailing dams.
W69-07473

A STUDY OF THE EXPENDITURES FOR URBAN WATER SERVICES,
Travelers Research Corp., Hartford, Conn.
For primary bibliographic entry see Field 06C.
W69-07483

SEWERED DRAINAGE CATCHMENTS IN MAJOR CITIES,
American Society of Civil Engineers, Cambridge, Mass. Engineering Sciences Lab.
For primary bibliographic entry see Field 02A.
W69-07486

EROSION CONTROL AT HOLLINGER MINE TAILING SITE,
Hollinger Consolidated Gold Mines Ltd., Timmins (Ontario).
For primary bibliographic entry see Field 02J.
W69-07489

ESTUARINE WATER QUALITY MANAGEMENT,
California State Water Resources Control Board, Sacramento. San Francisco Bay-Delta Program.
Richard L. Rosenberger, and Raymond Walsh.
ASCE Proc, J Sanit Eng Div, Vol 94, No SA5, Pap 6164, pp 913-926, Oct 1968. 14 p, 3 fig, 4 ref.

Descriptors: *Water quality control, *Estuaries, *California, Water resources development, Water management (Applied), Sewage treatment, Water pollution control, Deltas.
Identifiers: San Francisco Bay.

The San Francisco Bay-Delta Water Quality Control Program is a 3-yr study to develop a comprehensive plan for water quality control in the San Francisco Bay-Sacramento-San Joaquin Delta area of California. The program's total study area covers nearly 40% of the state. Vast water development projects will ultimately result in the complete control of inflow to the Delta and Bay during a substantial portion of most years. In developing a comprehensive water quality control plan the effect these projects will have on water quality must be considered along with problems resulting from disposal of agricultural drainage and the more conventional water pollution related factors associated with population and economic growth. The ultimate plan for water quality control in the Bay-Delta area, to be completely successful, will need to have incorporated into it the concepts of total water resources management. The implementation of such a plan will require the full cooperation of federal, state, and local water development agencies. (Knapp-USGS)
W69-07522

THE ADMINISTRATION OF OFFSHORE MINERAL LEASING STATUTES IN THE GULF OF MEXICO (LOUISIANA AND TEXAS),
G. Hardy, III.
Nat Resources Lawyer, Vol 1, No 3, pp 70-102, July 1968. 33 p, 62 ref.

Descriptors: *Louisiana, *Texas, Leases, *Land use, Federal jurisdiction, State jurisdiction, Natural resources, Administrative agencies, Conservation, Boundaries (Property), Oil, Gases, Sulfur, Shores, Coasts, Mineral industry, Gulf of Mexico, Marine geology, Interagency cooperation, Federal-state water rights conflicts.

The author traces the history and the past
present problems encountered by the states
Louisiana and Texas in establishing and adminis
ing leasing statutes and policies regarding offsh
areas. He reveals in detail the administrative str
ture and operation of, respectively, the Louisi
State Mineral Board and the School Land Boar
Texas. Sample offshore leases from both states
included as appendices to the article. The aut
notes the leasing custom and practice in b
states. He utilizes the bulk of the article to descr
various problem areas regarding offshore lea
which both Louisiana and Texas have faced and
compares the policies and efforts of the two st
to meet such problems. Among the problem ar
he discusses are: (1) the impact of offshore leas
of land for oil and gas operations on compet
uses of marine resources, (2) various adminis
tive problems, (3) the federal-state relationsh
regarding the administration of offshore lan
specifically, pollution, conservation, and bound
problems, and (4) intergovernmental relati
within each state as regards the leasing of offsh
lands. (Carruthers-Fla)
W69-07577

**RAW-WATER QUALITY CRITERIA F
PUBLIC SUPPLIES,**
For primary bibliographic entry see Field 05F.
W69-07578

NATIONAL WATER COMM'N.
For primary bibliographic entry see Field 06E.
W69-07580

PASSAIC VALLEY SEWERAGE DISTRICT.
N J Stat Ann sec 58:14-34.1, 58:14-34.2, 58:
34.10 to 58:14-34.12 (1966).

Descriptors: *New Jersey, *Sewage, *Sew
disposal, *Drainage system, Administration,
ministrative agencies, Legislation, Legal aspe
Water law, Financing, Financial Feasibility.

The Passaic Valley Sewerage Commissioners w
authorized to enter into leases for the use of the
tercepting sewers to dispose of additional sew
from a drainage area of the Passaic River.
legislature declared that there was a need
repair, replacement, and improvement of the ex
ing sewerage system and that the expense for
was a part of the cost of maintenance, repair
operation. It was further declared that the
system of financing was insufficient and inequita
for financing the new work; and that there wa
need to afford a practical means of relief by wh
the contracting municipalities could pay the exp
ses on an economical and reasonable basis ove
reasonable number of years. The commission
were given the power to enter into contracts t
would facilitate the maintenance, reconstructi
and operation of the sewerage system. They w
also given the authority to acquire all prope
deemed necessary or incident to any of the p
jects. (Holt-Fla)
W69-07585

DISPOSAL OF SEWAGE.
Conn Gen Stat Ann secs 25-25 through 25
(1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *Sewage dispo
*Sewage, *Pollution abatement, Pollutan
Legislation, State governments, Adjudicat
procedure, Public health, Sewage treatment, Cit
Administrative regulation.
Identifiers: Penalties, State waters.

The terms 'waters of the state' and 'sewage'
defined. The discharge into waters of the state
sewage prejudicial to public health is prohibit
The Commissioner of Health is given power to
spect and order alterations in all existing sewer
systems. No new systems may be built without
Commissioner's approval of the plan. The St

epartment of Health, upon its own motion or at ie request of city officials, may investigate alleged ollution sources. Appeals from department orders ay be made to the county superior court. The Deartment shall bring complaints in the superior ourt of Hartford County for failure to comply with s orders and the court may inforce the order in ny appropriate manner. Nothing in the statute hall be construed as recognizing a vested right to scharge sewage into state waters. The penalty for ich discharge shall be a fine of not more than 500 and/or imprisonment of not more than six onths. (Kahle-Fla)
/69-07599

/ATER AND ICE SUPPLIES.

onn Gen Stat Ann sec 25-32 thru 25-54 (1958), amended, (Supp 1968).

escriptors: *Connecticut, *Administrative agenes, *State governments, *Water supply, Legislaon, Streams, Water resources development, /ater conservation, Water utilization, Condemnaon, Legal aspects, Eminent domain, Water harsting, Subsurface waters, Surface waters, Public enefits, Public health, Public rights, Wastes, /ater pollution control, Pollution abatement, emedies, Adjudication procedure, Ice, Reserirs.
lentifiers: Injunctions (Mandatory).

he Department of Health has jurisdiction over all atters concerning the purity and adequacy of any ublic source of water or ice. The Department may vestigate any public system of water or ice supply nd shall issue such orders as are necessary to revent future pollution and to remedy any existing ontamination. Orders of the Department are eviewable by the superior court upon petition by n aggrieved party. It shall be a misdemeanor to put r leave a dead animal in any public water source. emeteries are not to be constructed within onelalf mile of any reservoir used by the public unless ie superior court finds that the proposed cemetery ill not be detrimental to public health. Muicipalities charged with the responsibility of water upply operations may initiate condemnation roceedings in superior court in furtherance of ich operation. Bathing in and pollution of public eservoirs is declared to constitute a misdemeanor. he Department is authorized to promulgate regutions protecting interstate waters from pollution. ce brought into the state for domestic use shall be spected by the Commissioner of Health. Injuncve relief may be granted to abate pollution of ublic water sources. (Katz-Fla)
/69-07600

HIEF OF DIVISION OF WATER RESOURCES ND WATER RESOURCES BOARD.

/ Va Code Ann sec 20-5A-3 thru 20-5A-4 (1966), s amended, (Supp 1968).

escriptors: *West Virginia, *Water pollution, Water pollution control, *Water resources, Pollunts, Pollution abatement, Water pollution effects, Vater pollution sources, Water pollution treatent, Water conservation, Disposal, Public health, tandards, Federal government, Legal aspects, egislation, Regulation, Administrative agencies, nvestigations.

he chief of the division of water resources is empowered to encourage voluntary cooperation by all ersons in controlling and reducing water pollution n the state. He may advise and consult with other tate governments and agencies and with the ederal government regarding scientific or other ertinent investigations. He may also receive oney for carrying out these studies. The chief hall encourage plans by municipalities and busiesses to control water pollution and educate the ublic concerning water pollution. The chief has he power and responsibility of ascertaining the exent of pollution in the state's waters and of enforcing sanctions against such pollution. The water resources board may promulgate rules and regulations to implement the powers of the board and of the chief, and has the authority to make investigations concerning water pollution. The board is also authorized to create public service districts to better control and reduce pollution in unincorporated areas. The division of water resources is designated as the water pollution control agency for West Virginia, for all purposes of the federal Water Pollution Control Act. (Kelly-Fla)
W69-07606

POLLUTION ABATEMENT AND CONTROL.
W Va Code Ann sec 20-5A-9 thru 20-5A-14 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Water pollution control, *Pollution abatement, *Disposal, Water pollution sources, Water pollution treatment, Water conservation, Legal aspects, Legislation, Public health, Sewage, Sewage disposal, Waste water disposal, Effluents, Industrial wastes, Permits, Administrative agencies, Discharge (Water$_0$.

The chief of the state's division of water resources may require persons who directly or indirectly discharge sewage or other wastes into or near waters of the state to file information concerning the characteristics, amount, and rate of flow of the discharge. Upon determining that any person is causing water pollution, the chief may issue orders requiring either that the waste discharge be halted, or that remedial action be taken to reduce pollution in the discharge to the extent that such action is practical and economically feasible. If the order requires remedial action, the person causing the pollution must seek a permit and begin appropriate steps to eliminate or reduce pollution in accordance with the order. Failure of the governing body of a municipality or corporation to vote funds for necessary action will not excuse non-compliance. The chief may extend the time limit fixed by his original order. Compliance with a past order issued by the division implies no right to continue existing pollution of the state's waters, and the state maintains the right to take necessary action in the future. (Kelley-Fla)
W69-07607

STATE DEPARTMENT OF HEALTH.
W Va Code Ann secs 16-1-3, 16-1-9 (1966), sec 16-1-9a (Supp 1968).

Descriptors: *West Virginia, *Public health, *Water quality control, *Sewage treatment, Water supply, Legislation, Cities, Diseases, Environmental sanitation, Fluoridation, Potable water, Social aspects, Water pollution, Water purification, Chemical wastes, Sanitary engineering, Sewage disposal, Bacteria, Biological treatment, Recreation, Drainage, Public benefits, Administrative agencies, Inspection, Filtration, Chlorination.

The state board of health is created to assume the obligations of all previously existing health agencies. The board has the duty of enforcing all laws respecting public health. It can inspect and control the sanitary conditions of streams, water supplies, and sewage facilities. The board may regulate public water systems, plumbing systems, sewage systems and treatment plants, swimming pools, chlorination and filtration plants, and the qualifications of those in control of the plants. A municipality may not establish any method of drainage unless such method shall be approved by the state department of health. If the department finds that an existing system is dangerous to public health, it may order alterations in such system. The board of health shall prescribe the bacteriological limits to which all public water supplies will conform. The board may also prescribe regulations limiting the chemical and physical qualities of water. (Shevin-Fla)
W69-07608

FLOATING SAWDUST INTO STREAMS.
Ga Code Ann sec 26-3701 (1953), as amended, (Supp 1968).

Descriptors: *Georgia, *Streams, *Sawdust, *Wood wastes, Legislation, Local governments, Wastes, Water law, Legal aspects, Organic matter, Waste disposal, Water pollution sources, Water pollution control, Legal aspects.

The floating of sawdust into streams is made unlawful. Violation of the law is a misdemeanor. However, the law only goes into effect in counties where it has been recommended by two grand juries in the county. (Childs-Fla)
W69-07617

DEPOSIT OF REFUSE IN NAVIGABLE WATERS.
33 USCA secs 407, 407a (1957), as amended, (Supp 1969).

Descriptors: *Legislation, *Federal government, *Navigable waters, Harbors, Bays, Navigable rivers, Obstruction to flow, Bridges, Dams, Permits, Regulation, Bulkhead line, Coastal structures, Docks, Jetties, Piers, *Waste disposal.
Identifiers: Corps of Engineers.

It is unlawful to discharge in any manner, from either shore or vessel, any refuse matter of any kind whatsoever, other than that in liquid form, into any navigable water of the United States or into any tributary thereof. When, the chief of the Corps of Engineers feels that anchorage and navigation will not be injured, the Secretary of the Army may permit waste disposal into navigable waters. The Secretary may limit or condition such discharge at his discretion and may grant a permit accordingly. In places where harbor lines have not been established and where deposits of debris of mines or stamp works can be made without injury to navigation, the Secretary may establish harbor lines and authorize such deposits to be made. It is unlawful for any person to use or take possession of any construction used by the federal government to preserve or improve navigable waters. (Katz-Fla)
W69-07646

PROTECTION OF NAVIGABLE WATERS - REGULATION OF TRANSPORTATION AND DUMPING REFUSE IN NAVIGABLE WATERS - PIERS AND CRIBS ON MISSISSIPPI AND ST CROIX RIVERS.

33 USCA secs 419, 420 (1957).

Descriptors: *Waste disposal, *Federal government, *Legislation, *Navigable water, Transportation, Oysters, Dredging, Navigation, State jurisdiction, Piers, Mississippi River, Federal jurisdiction, Federal-state water rights conflicts, Water resources development, Navigable rivers.
Identifiers: St Croix River, Corps of Engineers.

The Secretary of the Army is authorized to prescribe regulations to govern the transportation and dumping into any navigable water, or waters adjacent thereto, of dredgings, earth, garbage, and other refuse materials of every kind or description, whenever in his judgment such regulations are required in the interest of navigation. Such regulations shall be posted in conspicuous places for the information of the public, and any person or corporation which shall violate the regulations shall be deemed guilty of a misdemeanor. This section does not apply to any waters within the jurisdictional boundaries of any state which are now or may hereafter be used for the cultivation of oysters under the laws of such state, except navigable channels which have been or may hereafter be improved by the United States. The owners of sawmills on the Mississippi River and the Saint Croix River in the states of Wisconsin and Minnesota are authorized to construct piers or cribs in front of their mill property on the banks of the river, provided that the piers or cribs so constructed shall not

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interfere with or obstruct the navigation of the river. (SmithnFla)
W69-07647

PROTECTION OF NAVIGABLE WATERS - DEPOSIT OF REFUSE IN LAKE MICHIGAN NEAR CHICAGO.

33 USCA sec 421 (1957).

Descriptors: *Lake Michigan, *Water pollution control, *Federal government, *Legislation, Lakes, Waste disposal, Navigation, Illinois, Water supply, Indiana, Breakwaters, Federal jurisdiction, Navigable water, Federal-state water rights conflicts, Water resources development, Navigable rivers.
Identifiers: Corps of Engineers.

It is unlawful to discharge or cause to be discharged any refuse matter of any kind into Lake Michigan at any point opposite of Cook county Illinois or Lake county Indiana, within eight miles from the shore of the lake, unless such refuse shall be placed inside of a breakwater so arranged as not to permit its escape into the body of the lake and cause contamination. The provisions of this section do not apply to the construction, repair, and protection of breakwaters and other structures built in aid of navigation, or for the purpose of obtaining water supply. Any person violating any provision of this section is guilty of a misdemeanor. (Smith-Fla)
W69-07648

OIL POLLUTION OF COASTAL WATERS - PROHIBITION AGAINST DISCHARGE OF OIL IN UNITED STATES WATERS.

33 USCA secs 431, 432, 433, 434 (1957).

Descriptors: *Oil, *Water pollution control, *Federal government, *Legislation, Water pollution, Coasts, Ships, Navigation, Public health, Federal jurisdiction, Navigable waters, Federal-state water rights conflicts, Water resources development, Navigable rivers.
Identifiers: Secretary of the Army.

Except in case of emergency, imperiling life or property, or unavoidable accident, collision, or stranding, and except as otherwise permitted by regulations prescribed by the Secretary of the Interior, it is unlawful for any person to discharge or permit the discharge of oil from any boat or vessel into or upon the navigable waters of the United States and its adjoining shorelines. Any person discharging or permitting the discharge of oil from any vessel into such waters shall remove the vessel from the waters immediately. If such owner fails to do so, the Secretary may remove the oil or may arrange for its removal, at the owner's expense. These coasts and expenses shall constitute a lien on such vessel which may be recovered in proceedings by libel in rem. Any person who violates this section is punishable upon conviction by a fine not exceeding $2,500, or by imprisonment not exceeding one year, or by both fine and imprisonment for each offense. Any boat or vessel, other than those owned and operated by the United States, from which oil is discharged in violation of this section shall be liable for a penalty of not more than $10,000. (Smith-Fla)
W69-07656

THE DEPOSIT OF REFUSE IN N Y HARBOR AND ADJACENT WATERS IS PROHIBITED.

33 USCA secs 441, 442, 443, 444 (1957).

Descriptors: *New York, *Waste disposal, *Legislation, *Federal government, Sewers, Harbors, Permits, Ships, Federal jurisdiction, Navigable waters, Federal-state water rights conflicts, Water resources development, Navigable rivers.

The placing or discharging in any manner of refuse, dirt, dredgings, or other matter in the waters of the harbors of New York, Hampton Roads, or Baltimore, within the limits which shall be prescribed by the supervisor of the harbor, is forbidden. A violation of this section is a misdemeanor punishable by fine or imprisonment. In addition to the above penalties, any master or engineer, or persons acting in that capacity, on board any vessel who knowingly violate this section shall, upon conviction, have his license revoked or suspended for a term to be fixed by the judge. Whenever any such forbidden matter is received on board any scow or other vessel, the owner or master, before proceeding to take or tow the refuse to the place of deposit, shall apply for a permit defining the precise limits within which the discharge may be made. Any deviation from such discharging place specified in the permit is a misdemeanor. (Smith-Fla)
W69-07657

WATER POLLUTION CONTROL - CONGRESSIONAL DECLARATION OF POLICY.
33 USCA secs 466, 466-1, 466a, 466b, 466c (1967 Supp).

Descriptors: *Water policy, *Water pollution control, *Federal government, *Legislation, State jurisdiction, Pollution abatement, Cost sharing, Administrative agencies, Water pollution, Surface waters, Groundwater, Coordination, Water pollution sources, Federal jurisdiction, Navigable waters, Federal-state water rights conflicts, Water resources development, Navigable rivers, Cities.
Identifiers: Secretary of Health, Education and Welfare.

The policy of Congress concerning waterways is to recognize, preserve and protect the primary responsibilities and rights of the states in preventing and controlling water pollution, to support technical research relating to the prevention and control of water pollution, and to provide federal technical services and financial aid to state and interstate agencies and to municipalities in connection with the prevention and control of water pollution. A Federal Water Pollution Control Administration is created within the Department of Health, Education and Welfare by this section. The Secretary shall prepare comprehensive programs for eliminating or reducing the pollution of interstate waters and tributaries and improving the sanitary condition of surface and underground waters. The Secretary shall encourage cooperative activities by the states for the prevention and control of water pollution, and encourage the enactment of improved uniform state laws relating to the prevention and control of water pollution. (Smith-Fla)
W69-07658

WATER POLLUTION CONTROL - GRANTS FOR WATER POLLUTION CONTROL PROGRAMS - WATER POLLUTION CONTROL ADVISORY BOARD.

33 USCA sec 466d to 466h (1967 Supp).

Descriptors: *Water pollution treatment, *Federal government, *Legislation, *Navigable waters, Water pollution waste treatment, Sewage, Sewage treatment, Waste disposal, Water purification, Industrial pollution, Cost sharing, Administrative agencies, Federal jurisdiction, Federal-state water rights conflicts, Water resources development, Navigable rivers, Cities.
Identifiers: Secretary of Health, Education and Welfare, Water Pollution Control Advisory Board.

Five million dollars is authorized to be appropriated for the fiscal year ending June 30, 1967, and for each succeeding fiscal year to and including the fiscal year ending June 30, 1971. The Surgeon General is authorized to make grants to any state, municipality, or intermunicipal or interstate agency for the construction of necessary treatment works to prevent the discharge of untreated or inadequately treated sewage into any waters. This section enumerates the limitations of such federal grants and requires a determination of the desirability of all proposed projects. A Water Pollu Control Advisory Board is established within Department of Health, Education, and Welfar is composed of the Secretary or his designee, shall be chairman, and nine members appointe the President, none of whom shall be federal ficers or employees. The pollution of interstat navigable waters in or adjacent to any state states which endangers the health or welfare of persons shall be subject to abatement action as vided in this section. Any federal department agency having jurisdiction over any building, in lation, or other property, shall, insofar as pract ble, cooperate in preventing the pollution of waters with the Department and any state or a cy having jurisdiction over waters into which matter is discharged from such property. (Sm Fla)
W69-07659

NAVIGATION AND NAVIGABLE WATERS.

33 USCA secs 466i, 466j, 466l, 466m, 466n (1 Supp).

Descriptors: *Federal government, *Pollut abatement, *Water quality control, *Water po tion control, United States, Legislation, Naviga waters, Legal aspects, Sewage treatment, W pollution sources, Sewage, Boats, Ships, Admi trative agencies, Financing, Costs, Taxes, Tr ment facilities, Industrial plants, Standards, W quality, Economic impact, Investigations, Data lections, Waste disposal, Water pollution, Indus al waste, Municipal wastes.
Identifiers: *Litter, *Federal-state cooperat Secretary of Health, Education, and Welfare.

In connection with water pollution control, Secretary of Health, Education and Welfare utilize members of federal agencies and presc regulations to carry out the purposes of secti 466-466g and 466h-466k of this title. The Secr ry may prescribe the keeping and disclosure records by recipients of assistance under those tions, and shall have access to any records tinent to the grants received under them. Secretary, in cooperation with state pollution trol agencies, shall make detailed studies of economic impact of treatment facilities on gov mental units, and the standards required to national and state water quality standards in te of cost and personnel. The Secretary of the Inte shall conduct a full investigation on pollution navigable waters caused by litter and sew deposited in the waters from watercraft, an means of abatement of such pollution. A report recommendations shall be submitted to Congr The Secretary of the Interior shall fully investig methods of providing tax incentives and o financial assistance to industry to construct fa ties to abate pollution. (Harris-Fla)
W69-07660

DAUGHERTY V CITY OF LEXINGT (REASONABLE USE OF LAND).

249 SW 2d 755-759 (Ky 1952).

Descriptors: *Kentucky, *Reservoir stor *Reasonable use, *Sewage disposal, Local gov ments, Natural use, Water pollution sources, C sumptive use, Sewage treatment, Water sup Water storage, Water rates, Remedies, Judi decisions, Public benefits, Land tenure, Compe tion.

Plaintiff owned land near and above a priva owned artificial lake from which the City of L ington obtained its water. The county board of justment refused to grant plaintiff a permit to e a restaurant and tourist cabin, fearing that sewage from such businesses might pollute the ty's water supply. Plaintiff brought suit to rev this action. Plaintiff contended that his sewage trol system was adequate and that to deny him reasonable use of the land would be the equiva

f taking his property without compensation. loreover, such taking would not be for the benefit f the public but for the benefit of the private water ompany. Plaintiff appealed from a dismissal of his uit in the circuit court. The court affirmed the ower court's action, noting that the water comany, whose rates were regulated by the state, was reality only a management corporation allowed make a reasonable profit. The public had a irect interest in preventing appellant from using is land so as to endanger the public's water source, nce any added purification costs would be eflected in their water rates. (Gabrielson-Fla)
/69-07674

NTERSTATE COMM'N ON THE POTOMAC IVER BASIN.

Id Ann Code art 403, sec 407 (Supp 1968).

escriptors: *Maryland, *Interstate commissions, Interstate compacts, *Interstate rivers, River asin commissions, River basins, Virginia, West irginia, Pennsylvania, District of Columbia, Stanards, Regulation, Research and development, Vater pollution control, Water pollution sources, ndustrial wastes, Watersheds (Basins), Investigaons, Pollutant identification.
dentifiers: Potomac River, Potomac Valley Conrvancy Dist.

compact with the purpose of abating pollution in ie Potomac River Basin, is entered into by Marynd, West Virginia, Virginia, Pennsylvania and the istrict of Columbia. This compact creates the Inrstate Commission on the Potomac River Basin id the Potomac Valley Conservancy District hich comprises all areas drained by the Potomac. commission consisting of the governor of Marynd and two members appointed by him for two ar terms is created to act with like commissions the other signatory bodies. The commissioners each signatory board shall serve without comnsation, other than for expenses incurred. The mmission shall elect officers, appoint assistants, id adopt regulations for its management. No acon of the commission shall be binding on any gnatory body unless two commissioners from that dy voted in its favor. The commission shall have ie powers and duties to collect and disseminate isting information regarding pollution in the conrvancy district and to collect new data through vestigation. It shall cooperate with legislative dies to promote uniform laws and to recommend inimum standards for pollution control in the nservancy district. The commission shall be nanced by prorata contributions from the signatobodies, the total of which shall not exceed 30,000 per annum. Any signatory body may ithdraw from the compact after one year's notice. Kahle--Fla)
/69-07691

BATEMENT OF NUISANCES.

el Code Ann tit 16, sec 310 (1953).

escriptors: *Delaware, *Pollution abatement, Stagnant water, *Water pollution sources, Odor, ublic health, Diseases, Legal aspects, Legislation, anitary engineering, Soil contamination, Water ollution, Cities, Local governments.

ach local board of health may order the removal any noisome matter, filthy place, reservoir of agnant water or other nuisance which in its pinion is conducive to sickness or ill-health. The oard may order the persons responsible for caus- any such nuisance to abate, remove or remedy e nuisance. (Helwig-Fla)
/69-07692

EALTH AND SAFETY.

el Code Ann tit 16, secs 7907, 7929, 7930, 7931 953).

Descriptors: *Delaware, *Inspection, *Sewage, *Administrative agencies, Legislation, Evaluation, On-site investigations, On-site tests, Regulation, Water law, Legal aspects, Sewage disposal, Sewers, Cesspools, Waste disposal, Environmental sanitation, Potable water, Permits, Public health, Waste water (Pollution), Sanitary engineering, Social aspects, Water quality, Storm drains, Wells, Well permits, Water supply, Runoff, Plumbing.
Identifiers: Storm water sewage system.

Agents of the State Board of Health inspect and supervise all water and sewer systems, building and house drainage systems and their ventilation. Plumbing inspectors may enter any building or premises in the state when necessary for the performance of their duties and may inspect and order the removal of any plumbing fixture, pipe, or cesspool which they deem to be in an unsanitary condition. Storm waters must be drained into a storm water sewerage system or a combined sewerage system but not into a sanitary sewerage system intended for sewerage only. Privy vaults or cesspools are not permitted on premises accessible to a public sewer. Where a public water supply is available, dug wells or other sources of private water supply are unlawful unless approved in writing by the Board. (Johnson-Fla)
W69-07695

CESSPOOLS, PRIVY WELLS AND DRAINAGE SYSTEMS.

Del Code Ann tit 16, secs 1501-1507, (1953).

Descriptors: *Delaware, *Cesspools, *Waste disposal, *Drainage systems, Local governments, Administrative agencies, Waste water disposal, Drainage water, Sewage systems, Water supply, Drainage practices, Outlets, Sewers, Surface drainage, Legislation, Seepage, Administrative regulation, Water pollution, Water pollution control, Public health, Sewage disposal.
Identifiers: Privy wells.

The State Board of Health may regulate the construction of all cesspools, privy wells and other drainage systems within all towns and within 1 mile of the water supply thereof. The Board may order any changes in such drainage systems already constructed so as to protect public health and may order the owner thereof to construct such from brick or concrete to prevent the contents from seeping into the soil. The Board may prohibit the discharge of sewage over the surface of the ground. It may order the cleaning of any drainage system. All plans for the construction of water or sewage systems shall be submitted to the Board for approval. Violators of this chapter or regulations made pursuant to it shall be fined. (Helwig-Fla)
W69-07696

POLLUTION OF STREAMS.

Del Code Ann tit 16, secs 1301, 1302 (1953).

Descriptors: *Delaware, *Water pollution, *Streams, *Water pollution sources, Pollution abatement, Public health, Wastes, Industrial wastes, Water quality, Chemcontrol, Sewage, Organic wastes, Legislation, Judicial decisions, Water supply, Hogs, Water quality control.
Identifiers: Dye-stuffs, Slaughter houses.

No person shall discharge or allow any dye-stuffs, drugs, or chemicals which cause the stream to become noxious to the health or disagreeable to the senses to escape into any stream used as a water supply. In addition to imposing a fine for violation, the court shall also issue an abatement order within 20 days after conviction. The abatement shall be enforced by the sheriff. No person shall place a privy, hog-pen or slaughter house so as to pollute any stream with the excrement or offal therefrom. Violators shall be fined and the court shall order the nuisance abated immediately. (Helwig-Fla)
W69-07697

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

OPERATIONS RESEARCH STUDY OF WATER RESOURCES IN AN URBANIZED ARID ENVIRONMENT,
Arizona Univ., Tucson.
Chester C. Kisiel, and Lucien Duckstein.
International Conference on Arid Lands in a Changing World, Arizona University, Tucson, June 3-13, 1969. 24 p, 4 fig, 2 tab, 33 ref, map.

Descriptors: *Systems analysis, *Water resources planning, *River basin development, *Arid lands, River forecasting, Runoff forecasting, Competing uses, Conservation, Water management (Applied), Project planning, City planning, Long-term planning, Short-term planning, Economic efficiency, Estimating equations, Computers, Arizona.

This paper briefly reviews the philosophy of systems analysis or operations research, presents a progress report on application of this methodology to water resources development and management in the Tucson basin, Arizona, and presents a strategy for a study of the efficiency of data collection systems. Emphasis is on an integrated systems approach with the Tucson area as a field laboratory for improvement of methodology. Details of the basins water problems include economic growth, mining industry, agriculture and the municipal sector. Digital computer models of the physical system consider transferability of point precipitation data, time series analysis of actual stream flows and variability of natural recharge. Two different management approach models are examined for a community water supply, (a) to meet projected requirements at minimum costs, (b) to maximize net benefits accruing from water use. Efficiency of data collecting systems are evaluated in terms of economic efficiency, information content and worth in terms of construction of mathematical models of the physical system and water management schemes. The objectives of groundwater management models for the Tucson basin are enumerated. (Sherbrooke-Ariz)
W69-07350

WATER AND THE CITIES: CONTEMPORARY URBAN WATER RESOURCE AND RELATED LAND PLANNING,
Abt Associates, Inc., Cambridge, Mass.
For primary bibliographic entry see Field 06B.
W69-07479

DYNAMIC OPTIMIZATION FOR INDUSTRIAL WASTE TREATMENT DESIGN,
Weston (Roy F.), Inc., West Chester, Pa.
For primary bibliographic entry see Field 05D.
W69-07555

ANALYSIS OF WATER-RESOURCE SYSTEMS,
American Water Resources Association, Urbana, Ill.
Rolf A. Deininger, Martha N. Francisco, and Arnold I. Johnson.
Proc Nat Symp on Anal Water-Resource Syst, July 1-3, 1968, Univ of Denver, Colo. 390 p.

Descriptors: *Systems analysis, *Synthetic hydrology, Model studies, Groundwater, Surface waters, Water pollution, Estuaries, Water resources development, Water management (Applied), Water pollution control, Desalination, Water yield, Water sources, Mathematical models, Cost analysis, Optimization, Linear programming, Dynamic programming.
Identifiers: Water resources systems.

The use of systems analysis techniques in water resource management is discussed in 30 papers. The topics covered are systems analysis in various phases of water management, groundwater systems

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analysis, systems analysis in water supply and pollution control, surface water systems analysis, and estuary water quality and quantity systems. The uses of dynamic an linear programming are discussed, considering the stochastic nature of most hydrological data series. Systems analysis is an approach to evaluating the effects of varying parameters in complex systems with multiple interactions, with the aid of mathematical models solved by digital computers. See also W69-07563 thru W69-07575. (Knapp-USGS)
W69-07562

DYNAMIC PROGRAMMING IN WATER RESOURCES DEVELOPMENT,
Texas Univ., Austin; and Texas A and M Univ., College Station.
C. S. Beightler, and W. L. Meier.
Proc, Nat Symp Anal Water-Resource Syst, pp 64-71, Denver, July 1968. 8 p, 3 fig, 10 ref.

Descriptors: *Dynamic programming, *Water resources development, Optimum development plans, Decision making, River systems.
Identifiers: *Non-serial systems.

The technique of dynamic programming for determining the optimum level of development in water resource systems was outlined. The recursive relationship for a serial multistage system was developed. State variables were the inputs and outputs (e.g. flows) at each stage. The decision variables were the levels of development at each stage. Transformation functions relating inputs and development levels to outputs at each stage were assumed. The objective was to maximize the returns (functions of inputs and levels of development at each stage) from the system. The technique was then generalized to a branched system, with the recursive optimization technique working upstream as before until the first branch was reached. There, the two-decision, one-state optimization step was decomposed by the Principle of Optimality into an equivalent one-state, one-decision optimization. It was concluded that using the 'pseudo-stages' which resulted from the decomposition, that any branched multistage problem could be solved as a one-state, one-decision serial dynamic programming problem. For main entry see W69-07562. (Gysi-Cornell)
W69-07564

SYSTEMS ANALYSIS AND BASIN PLANNING FOR WATER RESOURCES MANAGEMENT,
Illinois State Water Survey, Urbana.
Robert H. Harmeson.
Proc, Nat Symp Anal Water-Resource Syst, pp 72-78, Denver, July 1968. 7 p, 2 fig.

Descriptors: *Systems analysis, *Water management (Applied), *River basins, *Planning, Water resources development, Water pollution control, Water supply, Recreation, Flood control, Air pollution.
Identifiers: Illinois Water Resources Model.

An effort by the State of Illinois to develop methodology of systems analysis, which could be used in devising the general strategy for the coordinated planning of water resources development and management throughout the state, was reported. A report entitled 'Water for Illinois--A Plan for Action', which addressed itself to the problems of water and land-related resources for the target dates of 1980 and 2020, was outlined. The report recommended the use of a comprehensive and detailed systems analysis of the State's total water resource, relating to water supply and use, water quality control, recreational water use, flood control, and to soil and water conservation measures. To develop an Illinois Water Resources Model, the state was divided into eight quasi-river basin areas. An attempt to develop sub-models for the various stated purposes, and to integrate the sub-systems into a regional optimization model was discussed. For main entry see W69-07562. (Gysi-Cornell)
W69-07565

GENERAL SYSTEMS APPROACH TO GROUNDWATER PROBLEMS,
Arizona Univ., Tucson.
For primary bibliographic entry see Field 04B.
W69-07567

ON MULTILEVEL OPTIMIZATION IN GROUNDWATER SYSTEMS,
California Univ., Los Angeles.
For primary bibliographic entry see Field 04B.
W69-07570

SYSTEMS ANALYSIS FOR WATER SUPPLY AND POLLUTION CONTROL,
Harvard Univ., Cambridge, Mass.
Joseph J. Harrington.
Proc, Nat Symp Anal Water-Resource Syst, pp 144-166, Denver, July 1968. 23 p, 82 ref.

Descriptors: *Systems analysis, *Water supply, *Water pollution control, *Mathematical models, Sanitary engineering, Water distribution (Applied), Cost analysis, Waste water treatment, Waste water disposal, Water treatment, Regional analysis, Engineering education, Demand, Publications, Reviews.

The stated purpose of the paper was 'to give a cursory overview of applications of systems techniques to the provision of water and the collection and acceptable disposal of waste water.' An extensive listing of past and present systems studies in the water supply-disposal area followed. The background and traditional approach to water supply and dispoal design problems was given. Studies on the development of cost data for design were listed. Systems studies for water distribution system design, maintenance (leak detection and metering), waste water treatment, unit processes, staged development of treatment works, suburban waste water disposal, metrology-automation and control, and miscellaneous studies in water treatment, waste water collection, regionalization, demand estimation, parameter estimation and model design, phase interchanges and social implications of engineering systems, and curriculum considerations were briefly described. It was concluded that most existing models are sub-optimization models and should be regarded as 'preliminary screening' tools that serve as guides but which must be tempered by judgment. For entry see W69-07562. (Gysi-Cornell)
W69-07571

COMPUTER SOLUTIONS TO DISTRIBUTION NETWORK PROBLEMS,
Boeing Co., Renton, Wash.
For primary bibliographic entry see Field 07A.
W69-07572

6B. Evaluation Process

THE DEVELOPMENT OF INTERNATIONAL WATER RESOURCES: THE 'DRAINAGE BASIN APPROACH',
For primary bibliographic entry see Field 06E.
W69-07305

DELAWARE RIVER BASIN WATER COMM'N COMPACT.
For primary bibliographic entry see Field 06E.
W69-07329

INCREASING THE POTENTIAL OF FUTURE WATER DEVELOPMENTS THROUGH IMPROVED ENGINEERING MANAGEMENT,
Bureau of Reclamation, Denver, Colo.
B. P. Bellport.
International Conference on Arid Lands in a Changing World, Arizona University, Tucson, June 3-13, 1969. 26 p.

Descriptors: *Arid lands, *Water resources planning, *Water resources development, Artificial precipitation, Evaporation, Evaporation con
Reservoir evaporation, Desalination, Water
servation, Monomolecular films, Phreatoph
Demonstration farms, Irrigation efficiency, C
puter programs, Engineering personnel, Deci
making, Systems analysis.
Identifiers: *Bureau of Reclamation.

This paper summarizes the Bureau of Recla
tion's programs which deal with the expan
water resources needs of arid regions and t
challenges to engineering managerial exper
The value and economy of using systems engin
ing in the decision-making process is discus
The Bureau's activities in importation of wa
both interbasin and undersea, are presented.
value of the electronic computer in more
phisticated analytical procedures and its reduc
of waste and cost is stressed, especially as relate
construction planning. Pipeline and irrigation c
systems are compared. The Bureau is studying w
by which irrigation can achieve higher crop yi
with less water and is investigating the scient
means for computing irrigation times and amou
for use in an automatic computerized system
maximum efficiency. Other areas of research
lined are weather modification, desalination,
cient evaporation-reduction materials, and con
of phreatophytes. A review of the Bureau's p
grams aimed at improvement of managerial
technical skills to meet the complex problems of
ture water resources development is includ
(Sherbrooke-Ariz)
W69-07345

PROJECTING HYDROLOGIC A ECONOMIC INTERRELATIONSHIPS GROUNDWATER BASIN MANAGEMENT,
Arizona Univ., Tucson.
William E. Martin, Thomas G. Burdak, and Robe
A. Young.
International Conference on Arid Lands in
Changing World, Arizona University, Tucson, Ju
3-13, 1969. 15 p, 1 fig, 1 tab, 12 ref.

Descriptors: *Economic evaluation, *Grou
water, *Analog models, *Hydrologic data, A
lands, Aquifers, Deep-well pumping, Border irri
tion, Water demand, Irrigation practices, Irrigat
wells, Arizona, Decision making, Analyti
techniques, Projections, Inter-basin transf
Economic prediction, Water management, We
Pumping.

This study is a computerized approach to an ana
sis of groundwater problems in arid areas hav
high irrigational demands. In order to provid
criteria for projecting the consequences of alter
tive water management schemes for Pinal C
Arizona, a procedure using both formal econo
and hydrologic models was devised. The projec
reactions of farmers using pumped water to cha
ing economic conditions and public policies
presented for representative farms by linear p
gramming models. Traditional optimization
sumptions of economic theory are employed. T
hydrology of the underground water basin
represented by an electric-analog model of
U.S.G.S. Projection for the next 50 years show
gradual decline in low-valued, marginal crops
the economic disadvantages of water importat
rescue operations. (Sherbrooke-Ariz)
W69-07353

IRRIGATION AS A MENACE TO HEALTH CALIFORNIA: A NINETEENTH CENTU VIEW,
California Univ., Davis. Dept. of Geography.
Kenneth Thompson.
Geogr Rev, Vol 59, No 2, pp 195-214, Apr 19
20 p, 1 tab, 80 ref.

Descriptors: *Irrigation water, *Environmental
fects, *California, *Irrigated land, Parasiti
Marshes, Statistics, Rice, Land reclamati
Vegetation effects, Climates, Summer, Winter.
Identifiers: Irrigation health effect.

rigation effects on health, mainly as a 19th centu- / view held in California, are discussed on the asis of earlier publications in California. The arti- le contains the following chapters: (1) the nature f malaria; (2) the prevalence of malaria in Califor- ia; (3) official inquiries; (4) context of the irriga- on fear; (5) California concern over irrigation; 6) opposition to irrigation; (7) neutralism and ualified support; (8) the positive attitude; and (9) ie controversy in perspective. The author sum- iarizes the study by stating that the neutral or iore or less optimistic view of irrigation develop- ient eventually proved to be justified. Moreover iedical science turned its attention to microbiolo- y and the microorganism became the focus of con- ern and the medical climatology and medical pography, so popular in nineteenth-century alifornia and elsewhere, are virtually abandoned. Gabriel-USGS)
/69-07372

UCCESS OF WATERSHED DEVELOPMENT N LOCAL COMMUNITIES,
Oklahoma State Univ., Stillwater.
homas P. Cox.
latur Resources J, Vol 9, No 1, pp 23-34, Jan 969. 12 p, 1 fig, 4 tab.

escriptors: *Water resources development, Watersheds (Basins), *Watershed management, Oklahoma, Statistical methods, Regression analy- s, Political aspects, Social aspects, Governments. dentifiers: Factor analysis.

actor analysis was applied to the programs of 115 atershed development projects in Oklahoma, and was found that the interest and involvement of ie whole community was more important in romoting development than was the influence of ny limited-interest group, even conservation and ater development agencies. A surprising finding as that community standard of living and atershed development are not linearly related, ut the highest development rates are associated ith the highest and lowest community living stan- ards, with the lowest rates at intermediate com- unity levels. (Knapp-USGS)
/69-07392

QUEDUCT EMPIRE,
rwin Cooper.
lendale, Calif, Arthur H. Clark Co, 1968. 439 p, 8 photo, 1 map, index.

escriptors: *Water resources development, California, Water management (Applied), Mu- icipal water, Irrigation water, Industrial water, ams, Aqueducts, River training, Water wells, esalination, Water law, Flood control, Mining, ater pollution control, Lakes, Reservoirs, ecreation, Multiple-purpose projects. dentifiers: California water development.

alifornia's water resources development is escribed in a popular history book that mphasizes the construction of dams, aqueducts, nd other large engineering projects. The growth of opulation and of per capita water consumption is iscussed in terms of the challenges successfully et and those projected for the future in a State ith uneven distribution of rainfall, and with the eaviest population and agricultural development the driest areas. Irrigation water, municipal ater, and industrial water are all intensely eveloped in California, and with a projected oubling of population by the year 2000, together ith the expected per capita use increase, the roblems to be met will be enormous. Flood con- ol, river training, and pollution control projects re also discussed. (Knapp-USGS)
/69-07415

RITON CITY: A PROTOTYPE FLOATING OMMUNITY.
riton Foundation, Inc., Cambridge, Mass.
Available from Clearinghouse for Federal Scientific and Technical Information, Springfield, Va., as report PB-180 051 at $3.00 in paper copy and $0.65 in microfiche, November 1968. 15 p, 1 append, 23 ref.

Descriptors: *Waterfront development, *Community development, *Prototypes, Structural design, Neighborhood development, Social aspects, Population density, Economic feasibility, Technical feasibility.
Identifiers: *Floating community.

A feasibility study to determine the possibility of developing the water areas of major cities by floating new communities on the water adjacent to the urban core, the technical considerations indicate that such a structure is possible. The basic unit of Triton City is a neighborhood-sized community which will accommodate 3500 to 6000 people and which will support an elementary school, a small supermarket and local convenience stores and services. Three to six of these neighborhoods will form a town which will include a high school, more recreational and civic facilities and possibly light industry. When a community reaches the level of three to seven towns (90,000 to 105,000 population) it becomes a full-scale city with more specialized industry and a city center module to accommodate government offices and medical facilities. The high density occupation results in great economies in transportation service and other utilities. One of the other important benefits of this type of development is the advantage of waterfront living in the central city - urban convenience and suburban open space. (Starr-Chicago)
W69-07448

WATER RESOURCES PROBLEMS AND RESEARCH NEEDS,
A. W. Snell.
Water Resource Research Institute, Clemson University, S. C. Proceedings - Sixteenth SWRPCC - 1967, pp 161-167. 7 p, 8 ref.

Descriptors: *Research and development, Systems analysis, Flood plains, Industrial wastes, Judicial decisions, Site selection, Economic impact.
Identifiers: Local participation.

Research needs for effective water resources planning are cited in this article. They include: (1) Economic value of water in various uses; (2) impact of water resources development on economic growth; (3) economics of management of flood plains; (4) the biochemical effect of present and projected disposal practices of industries and municipalities; (5) economics of site selection; (6) compilation of court decisions and statute laws relating to water use and water rights; and (7) compilation of population and industrial projected needs to determine probable demand. Additional requirements which should not be overlooked include the use of systems analysis applied to problems in water resources and generating local interest in water resources development. (Starr-Chicago)
W69-07451

WATER RESOURCES DEVELOPMENT OF MULLICA RIVER BASIN, NEW JERSEY,
Rutgers - The State Univ., New Brunswick, N. J. Water Resources Research Inst.
James B. Durand, Marvin L. Granstrom, and George H. Nieswand.
OWRR Project B-014-N.J. June 1969. 4 p.

Descriptors: Ecosystems, Aquatic life, Nutrient requirements, Conjunctive use, Systems analysis, Estuary, New Jersey.
Identifiers: *Mullica River Basin, Bay-river system.

The eventual use of the Mullica River basin for water supply will affect the ecosystems in the river-bay complex. Over a period of almost a decade, a biologist group has been observing the physical, chemical, and biological characteristics of the complex. Recently, an engineer group has joined the biologists. The engineers' objectives are to develop methods of orderly planning the optimization of water supply development and minimization of the effect of fluvial water withdrawal on the bay-river system.
W69-07456

THE ECONOMIC IMPLICATIONS OF THE INTERCONNECTION OF URBAN WATER SYSTEMS,
Temple Univ., Philadelphia.
Paul Seidenstat.
Philadelphia, Bureau of Economic and Business Research Occasional Paper no. 2, 1969. 25 p. OWRR-14-01-0001-1976.

Descriptors: *Water supply, *Water utilization, *Water resources development, *Water shortage, Water distribution (Applied), Water management (Applied), Planning, Economic efficiency.

This paper examines the market for water sold by public water systems in the Philadelphia metropolitan area to determine the economic feasibility of water interchange among contingent water systems. Analysis of the supply network and pattern of water use presented in several tables reveals considerable unused capacity at both the raw and treated water levels for many systems; however, a few are plagued by occasional deficiencies. Projections of future use indicate the continuance of much excess supply. The coexistence of 'surplus' and 'deficit' suppliers has led to a practice of tradeoffs - either on an emergency or a continuing basis. Not only are present interconnections economically feasible but there is also considerable potential for future ones. A regional approach to water system development might eliminate much of the apparent economic waste related to excess capacity.
W69-07468

WATER AND THE CITIES: CONTEMPORARY URBAN WATER RESOURCE AND RELATED LAND PLANNING,
Abt Associates, Inc., Cambridge, Mass.
P. Raven-Hansen, J. M. Yudelson, and M. J. White.
Available from Clearinghouse as PB 184 699 at $3.00 in paper copy and $0.65 in microfiche. Cambridge, Massachusetts, Abt Associates, Inc. OWRR Project C-1469. June 30, 1969. 507 p.

Descriptors: *Water pollution control, *Water quality management, *Waterfront land use, *Recreation, Storm water drainage, Combined sewer overflows, Sewer separation, Municipal waste treatment, Chlorination/detention tanks, Holding tanks, Sludge disposal, Urbanization, Hydrologic environment, Systems Analysis.
Identifiers: *Social planning, *Deep tunnel flood and pollution control, *Psychological public goods, Boston, Chicago, Columbia, Detroit, Little Rock, Los Angeles, New Orleans, Pittsburgh, San Antonio, Seattle, Waterfront striplands, Recreation standards, Blue-green drainage planning.

Ten case studies of urban water resources and related land planning are presented, based on interviews with urban planners, citizens' groups, and engineering consultants, and on current planning documents from each city. Water quality management, waterfront land use, water-related recreation and open space, and metropolitan growth are identified as critical problem-areas in planning the interactions of urban activity and the water resource. The lack of feedback from planning engineers to the regulatory agencies which set water quality standards is identified as a major constraint on efficient water qualtiy management and planning. The inability to respond to changing land uses is identified as a major constraint on waterfront land use planning. A neglect of the distributional aspects of urban water recreation development is identified as a constraint on the effectiveness of its planning. Jurisdictional fragmentation and/or competition is identified as a constraint on

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the planning and control of metropolitan growth. From the analysis of the planning experience, general guidelines for urban water resources planning in the four problem-areas are formulated in the language of systems analysis.
W69-07479

A STUDY OF THE EXPENDITURES FOR URBAN WATER SERVICES,
Travelers Research Corp., Hartford, Conn.
For primary bibliographic entry see Field 06C.
W69-07483

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

METHODS OF FINANCING STATE PARTICIPATION IN WATER RESOURCES DEVELOPMENT,
Kansas Water Resources Research Inst., Manhattan.
Darwin W. Daicoff.
Contribution No 4, Kansas Water Resources Research Institute, Kansas State University, Research conducted September 1965 - August 1966. 34 p. OWRR B-003KAN.

Descriptors: *Financing, *Cost allocation, Interagency cooperation, Cost-benefit analysis, Taxes, Economic efficiency, Administrative agencies, State jurisdiction, Legal aspects, Federal jurisdiction, Kansas, Texas, Wisconsin.
Identifiers: User charges, Spillover benefits, Local jurisdiction.

The objective is to determine the most efficient revenue system for a water resources development project. Section I, the body of the report, incorporates a discussion of spillover benefits and the cost allocation problems they create into an analysis of the interjurisdictional relationships involved in revenue system. Sub-topics discussed include the problem of choosing an agency to administer the revenue structure; the reasons that financing should be administered by legal coercion rather than voluntary cooperation; the change in state and local roles depending on whether the places of benefit and residence are the same; and the legal precedents for federal supervision of financing found in federal laws and in Kansas laws and policies. Section II, assuming a fixed revenue system examines the way to compose a particular project. The method of benefit-cost analysis is discussed and its proper application to the determination of a project's composition is described. Section III analyzes the relative merits of user charges and taxes, and examines the appropriateness of Texas and Wisconsin revenue procedures. Results show that an 'economically proper' revenue system cannot be constructed because the projects themselves do not use any economic efficiency criterion in determining their composition. (Gossen-Chicago)
W69-07447

A STUDY OF THE EXPENDITURES FOR URBAN WATER SERVICES,
Travelers Research Corp., Hartford, Conn.
LeRoy H. Clem.
ASCE Urban Water Resources Res Program Tech Mem No 7, February 1969. 21 p, 2 tab, 11 ref. OWRR Contract No 14-01-0001-1585. Available from Clearinghouse as PB 184 702 at $3.00 in paper copy and $0.65 in microfiche.

Descriptors: *Municipal water, *Water costs, *Connecticut, Cost analysis, Water sources, Water supply, Storm runoff, Water treatment, Water pollution control, Operating costs, Construction costs, Economics, Water rates.
Identifiers: Hartford (Conn).

A study was undertaken to determine the feasibility of and provide guidelines for analyzing all urban water service costs and to determine their relationship to other local government expenditures, such as education, public works, and law enforcement. The City of Hartford was chosen for the pilot investigation because the manager's fiscal practices were suitable and appropriate records were available, and the cooperation of key city personnel was promised. Total cost of Hartford's water services has decreased from $8.5 million (17.4% of annual city budget) in 1965 to $5.1 million (7.4% of budget) in 1968. The decrease is due to completion of a major storm drainage project. Water sales were nearly constant at about $2.4 million during each of the 4 years under review. The city is the major participant in the local metropolitan water district which also embraces many adjacent towns. Hartford has over the years been subjected to catastrophic flooding from the Connecticut River. Local efforts and the Corps of Engineers have worked in conjunction to eliminate the flooding problem, but the city has low-lying areas requiring storm runoff pumping. At present, the sewerage and storm drainage systems are combined but steps are being taken to separate them. Urban water service costs can be analyzed and their relationship to other local expenditures determined. An approach recommended for nationwide studies is given. (Knapp-USGS)
W69-07483

6D. Water Demand

WATER – OUR ENGINEERING RESPONSIBILITY,
A. W. Snell.
Agricultural Engineering, Vol 48, No 12, pp 707-709, December 1967. 3 p, 12 ref.

Descriptors: *Water demand, *Water use, *Water quality, Social impact, Political aspects.
Identifiers: Alternative plans.

The main thesis of this article is that while there will be no major national water shortage there will be the problem of distribution in time and space and of preserving a suitable quality. There will be local water shortages caused by dense population with high needs. There will also be conflicts of interest and demand for the same source of water and conflicts which develop because of the effect one user has on the quality for subsequent users. Solving these problems will require that full consideration be given to the prevailing physical characteristics, the economies of the plan, the economies of available alternatives, the effects of each alternative on the social condition of the people, and the political decisions that must be made. (Starr-Chicago)
W69-07450

PROTECTION OF NAVIGABLE WATERS - INVESTIGATIONS CONCERNING EROSION OF SHORES OF COASTAL AND LAKE WATERS.
For primary bibliographic entry see Field 04D.
W69-07655

6E. Water Law and Institutions

APPLICATION OF HUIE (CONDEMNATION AWARDS).

2 A D 2d 786, 154 NYS 2d 242 (1956).

Descriptors: *New York, *Condemnation value, *Withdrawal, *Streams, Judicial decisions, Legal aspects, Compensation, Cities, Recreation, Eminent domain, Relative rights, Rivers.

Claimants own property near a river to which they have recreational rights subject to an intervening riparian owner's right to deplete any or all of the water. Petitioner acquired the riparian interest in order to make use of the river for water supply purposes. The court held that the appraisal commissioner's award of damages to the claimants was excessive in view of the fact that the previous riparian owner could have depleted all of the waters without becoming answerable to claimant. (Molica-Fla)
W69-07264

UNITED STATES EX REL TVA V 137 ACI OF LAND (PROPER COMPENSATION IN C DEMNATION PROCEEDING).
406 F 2d 1283-1289 (6th Cir 1969).

Descriptors: *Tennessee, *Tennessee Va Authority Project, *Condemnation, *Compe tion, Road construction, Legal aspects, Judi decisions, Administrative agencies, Emi domain, Federal government, Tennessee Ri Dams, Reservoirs, Highways, Recreational fa ties, State governments, Bridges, Damages, Fl ing, Ditches, Parks, River Basin development, C tracts, Condemnation value, Roadbanks.

In an action for condemnation of certain lands use by the Tennessee Valley Authority, the lo court awarded the landowners $34,000 and t appealed. Prior to the taking by the TVA, the S of Tennessee had taken a 12-acres plot of the l in question in order to build a highway. highway project increased the value of the l since it was made suitable for restaurants, mo and other purposes. The landowners conten that the enhancement in value of the prop brought about by the highway project should in to their benefit rather than to the TVA. TVA c tended that their project brought about establ ment of the interchange and that the landown should not be entitled to any enhancement in va The court found that the enhancement in value not brought about by the proposed dam, but by proposed state highway improvement. The c held that the burden of proving that the pro brought about the enhanced value of the land on TVA and that it failed to meet this burden. court held the landowners were entitled to value of their land on the date of the taking. court found that the highway project was plan prior to the TVA's taking and thus held the l downers entitled to an award of $97,500. (She Fla)
W69-07265

THE MARINE ENVIRONMENT – RECE LEGAL DEVELOPMENTS,
Oliver L. Stone.
Nat Resources Lawyer, Vol 11, No 1, pp 26-46, 1969. 21 p, 25 ref.

Descriptors: *United States, *United Nations, * ternational law, *Submerged lands act, Conju tive use, Texas, Louisiana, Alabama, Florida, G of Mexico, Atlantic Ocean, Oceans, Mineral Continental shelf, Continental slope, Contine margin, Coasts, Coastal plains, Beds under wa Ownership of beds, Oil industry, Exploitati Legal aspects, Usufructuary right, Judicial de sions, Reasonable use, Navigable waters, Harb Bays, Offshore platforms, Riparian land, Litto Subsoil, Subsurface investigations, Drilling.

There has been an upsurge in the number of rec legal developments concerning marine envir ment. Interest is being focused internationally u the question of the seaward limit of the contine shelf regime embodied in the Geneva Convent on the continental shelf as well as the issue of w legal regime applies or should apply to the s oceanic resources beyond the continental sh regime. On the domestic side, recent cases h arisen involving where the coast line of individ states is to be measured from under the Submer Lands Act. Questions of state sovereignty o reefs lying within the contiguous zone of tw miles but beyond the traditional three-mile li arose in a recent Florida case. These issues discussed in detail. (Katz-Fla)
W69-07266

THE MARINE ENVIRONMENT – RECE LEGAL DEVELOPMENTS,
Oliver L. Stone.
Nat Resources Lawyer, Vol 11, No 1, pp 26-32, 1969. 21 p, 25 ref.

escriptors: *United States, *United Nations, *International law, *Submerged lands act, Texas, orida, Louisiana, Alabama, Gulf of Mexico, Atntic Ocean, Oceans, Mineralogy, Continental elf, Continental margin, Coasts, Coastal plains, eds under water, Ownership of beds, Oil industry, cploitation, Legal aspects, Usufructuary right, Jucial decisions, Reasonable use, Navigable waters, arbors, Bays, Offshore platforms, Riparian land, ibsoil, Subsurface investigations, Drilling, Conctive use, Legislation, Structures.

ne supreme court, in United States v Louisiana, eld that under the Submerged Lands Act a state ay claim a seaward boundary to a three-mile oint from its coastline or may claim a coastline sed on its historic boundary. An historically sed coastline must be measured as it existed on e date of the claimant state's entry into the nion. Under the Convention on the Territorial a a bay is delineated by the semicircle test. This st, accepted by the United States, requires that a y comprise at least as much water area within its osing line as would be contained in a semicircle th a diameter equal to the length of the closing e. In United States v Ray, certain parties asserted e right to erect a structure on reefs located ten iles off the Florida coast. The court, in enjoining e defendants from further activity, noted that the abed of the outer continental shelf adjacent to e United States appertains to the state and is subct to federal control, jurisdiction and power of sposition. (Katz-Fla)
69-07267

HE MARINE ENVIRONMENT -- RECENT EGAL DEVELOPMENTS,
iver L. Stone.
at Resources Lawyer, Vol 11, No 1, pp 32-43, Jan 969. 21 p, 25 ref.

escriptors: *United States, *United Nations, *International law, *Submerged lands act, Texas, orida, Alabama, Louisiana, Reefs, Gulf of Mexo, Atlantic Ocean, Oceans, Structures, Coasts, egislation, Mineralogy, Continental shelf, Conental margin, Coastal plains, Beds under water, wnership of beds, Oil industry, Exploitation, gal aspects, Usufructuary right, Judicial decions, Reasonable use, Navigable waters, Harbors, ys, Offshore platforms, Riparian land, Littoral, bsoil, Subsurface investigations, Drilling.

ne Marine Resources and Engineering Developent Act authorizes various studies to be unrtaken relating to marine resources. A recent udy suggests redefining the continental shelf, endg it at the 200 meter isobath with a buffer zone of miles being established between the 200 meter e and the deep sea. The coastal state would leave clusive rights of exploitation within the buffer ne. The existing shelf regime accepted by 39 naons presently extends beyond the 200 meter obath and it is questionable that these states ould be willing to surrender 'vested' rights. The ational Petroleum Council recently concluded at coastal states have exclusive jurisdiction over e natural resources of the continental land mass award to where the submerged portion of the nd mass meets the abyssal ocean floor. The NPC ted that an urgency to develop a regime for the ean floor beyond national jurisdiction does not esently exist. The author concludes that the arine Sciences Commission report will greatly duce the uncertainty concerned with developing egime for the ocean floor beneath the high seas. atz-Fla)
69-07268

HE MARINE ENVIRONMENT -- RECENT EGAL DEVELOPMENTS,
iver L. Stone.
at Resources Lawyer, Vol 11, No 1, pp 43-46, Jan 969. 21 p, 25 ref.

escriptors: *United States, *United Nations, *International law, *Submerged Lands Act, Texas, ouisiana, Alabama, Florida, Gulf of Mexico, Atlantic Ocean, Oceans, Mineralogy, Continental shelf, Continental slope, Continental margins, Coasts, Coastal plains, Beds under water, Ownership of beds, Oil industry, Exploitation, Legal aspects, Usufructuary right, Judicial decisions, Reasonable use, Navigable waters, Harbors, Bays, Offshore platforms, Riparian land, Littoral, Subsoil, Subsurface investigations, Drilling.

The Maltese Mission to the United Nations recently proposed that the General Assembly should consider the propriety of making a declaration reserving the seabed and ocean floors beneath the high seas exclusively for peaceful purposes and uses. Such a declaration would not effect waters presently under national jurisdiction. The proposed declaration envisages a treaty which would create an international agency. This agency would act as trustee for all nations over the seabed and ocean floor beyond national jurisdiction. This proposal prompted domestic action in the United States Senate generally in accord with the Maltese proposal, but no definitive action was undertaken by the 90th Congress. The United Nations, in response to the Maltese proposal, has created a Committee of Nations to study the proposal. The Committee failed to reach consensus on the principles to be applied to the proposal. However, the Committee did agree that the area in question will be used only for peaceful purposes and in the interest of mankind. It is also agreed that the rights of coastal states will be respected. If proved impossible to agree to a delineation of the area in question. (Katz-Fla)
W69-07269

WILFUL OBSTRUCTION TO NAVIGATION.
Conn Gen Stat Ann secs 53-93, 53-110, 53-112, 53-136 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *Alteration of flow, *Bridges, *Fisheries, Navigable waters, Canals, Gates, Locks, Banks, Dams, Aqueducts, Piers, Fish hatcheries, Fish conservation, Farm ponds, Damages, Burning, Flumes, Diversion, Cities, Water supply, Utilities, Navigation, Lumber.
Identifiers: (Obstruction to navigation, Penalties (Criminal), Water meters.

Any person who wilfully obstructs the navigation of any canal or opens or shuts any gate or lock of the canal or does any damage to the canal, may be fined and/or imprisoned. No person shall be permitted to trespass upon or remove fish from any hatchery controlled by the State Board of Fisheries and Game without permission from that body. No person shall damage appliances used by the Board or damage any pond, dam, receptacle or fence used by the Board. Violators are subject to fine. Any person maliciously injuring any bridge, lock, dam, or wood of another may be fined and/or imprisoned. Any person who, with intent to defraud, diverts water from another, a water company, or a municipality, or defrauds the meter measuring his consumption of water shall be subject to fine and/or imprisonment. (Shevin-Fla)
W69-07270

SHELLFISH.

Conn Gen Stat Ann secs 19-52 to 19-59 (1960).

Descriptors: *Connecticut, *Shellfish, *Public health, *Pollutants, Legislation, Clams, Commercial shellfish, Mussels, Oysters, Regulation, Baits, Population, Boats, Permits, Shores, Tidal waters, Cities, Commercial fishing, Fish harvest, Docks.
Identifiers: Notice, Penalties (Criminal), Transplantation (Shellfish).

The word 'shellfish' means mussels, oysters, and all varieties of clams. The State Board of Health may inspect shellfish beds, boats, appliances used in preparation of shellfish for market, and all wharves and buildings where shellfish are prepared for shipment or sale. The Board may prescribe regulations for growth, production, and preparation of shellfish for market. All persons dealing in shellfish must obtain certificates of identification, and the Department may require that all shipments be marked in such a way as to identify the shipper. Certification may be revoked after a hearing and upon showing of cause. Any person whose certificate has been revoked may appeal to the county court. The Department may prohibit the taking of shellfish from certain areas which it deems contaminated; however, cities may allow the taking from that area for use as bait. The Department, upon contaminating an area, must publish notice in the local newspapers, file notice in the local department of health, and post notice at the designated area. Any person violating any provisions of the section may be fined or imprisoned. Persons may remove shellfish from contaminated areas and transplant them in approved areas after they have been authorized to do so by the department of health. (Shevin-Fla)
W69-07271

ELIMINATION OF MOSQUITO-BREEDING PLACES.

Conn Gen Stat Ann secs 19-50, 19-51 (1960), as amended, (Supp 1968).

Descriptors: *Connecticut, *Public health, *Mosquitoes, *Swamps, Legislation, Bogs, Coastal marshes, Drainage wells, Marshes, Stagnant water, Larvae, Drains, Landfills, Damages, Ditches, Canals, Regulation.
Identifiers: Tidegates, Breeding, Penalties (Criminal).

The Commissioner of Health may make regulations concerning the elimination of mosquitoes and may enter any swamp, marsh, or land to determine if it is a breeding place and order it drained or filled to eliminate the insects. Notice of the area affected and the operation to be carried out must be published in the town where the land is located, and the owners must be notified by registered mail. The Commissioner shall assess the damage caused to the property and file his assessment in the county court. Any person aggrieved by the plan or the assessment may file for relief in the county courts. When any area has been drained by the Commissioner, he shall keep the area in repair and free from obstruction and make such repairs as will make the work effective. Any person obstructing the work of the Commissioner in so treating mosquito breeding areas shall be subject to fine or imprisonment. (Shevin-Fla)
W69-07272

RAILROADS.

Conn Gen Stat Ann secs 16-82, 16-95, 16-134 (1958).

Descriptors: *Connecticut, *Railroads, *Canals, *Highways, Legislation, Construction, Bridges, Navigable waters, Nonnavigable waters, Transportation, Streams, Bridge construction, Alteration of flow, Highway relocation, Watercourses (Legal), Channels, Design flow, Structures, Boats, Regulation.

Companies may alter the location of its road in order to add to the number of its main tracts and, for that purpose, may take additional land. If an additional bridge over navigable water is required to add to the main track, it shall be constructed according to specifications set by the railroad commission. When railroad construction must intersect a nonnavigable watercourse or public highway, the company must obtain approval of the commission to construct across it. The company must restore the watercourse or highway to its former state and not impair its usefulness. If construction across a highway cannot be done without damage to the highway, the company may, with the approval of the commission, change or alter the highway, but the highway must be maintained in as good a condition as it was before the alteration. The commission may order the location of a canal or watercourse

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changed in order to allow the railroad to be more advantageously constructed. The flow of water in a changed watercourse cannot be impaired, and the expense of making necessary changes in order to maintain the watercourse must be borne by the railroad. The section does not apply to canals maintained in a condition of navigation. (Shevin-Fla)
W69-07273

HARBORS AND RIVERS ACT OF CONNECTICUT.
Conn Gen Stat Ann secs 15-13 to 15-16 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *Harbors, *Permits, Navigable waters, Navigation, Federal jurisdiction, Ships, Boats, Channels, Legal aspects, Navigable rivers, Legislation, Regulation.
Identifiers: *Pilots.

The superior court of any county adjoining navigable waters may license as many residents of the state as the court deems necessary to act as pilots in the state's waters. The applicants must already hold a license from the authorized federal agency. Applicants must serve an apprenticeship, during which period they shall observe and assist docking by licensed pilots. Applicants must be bonded. Generally, the superior court of any county shall, upon application, fix the rates of pilotage in the waters of that county. All inward and outward bound vessels of foreign bottom and American vessels under register, drawing nine or more feet of water must take a licensed pilot when entering or leaving a state port. Coastal trading American vessels and certain fishing vessels are exempt from this requirement. The commander of any vessel, wholly or partly propelled by power, which travels at a greater rate than six miles per hour when approaching or passing anchored vessels or specified piers and wharves, shall be liable for fines and treble damages for injury which the vessel causes. (Kelly-Fla)
W69-07274

HARBORS AND RIVERS ACT OF CONNECTICUT.

Conn Gen Stat Ann secs 15-8 to 15-12 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *Harbors, *Navigation, *Coastal structures, Ships, Boats, Legal aspects, Piers, Docks, Piles (Foundations), Legislation, Channels, Channel flow, Barriers, Navigable rivers, Navigable waters, Regulation.

The harbor master may station under his care all vessels at anchor in the harbor channel and vessels so moored that they may be carried into the channel. The master may remove vessels which, in his judgment, will obstruct navigation, and he may decide to what place in the harbor such vessel should be removed. Any person willfully refusing or neglecting the order of a harbor master subjects himself to possible fines and assessment of costs of removal and legal expenses. A harbor master may be fined and charged expenses for neglecting to remove a vessel obstructing its channel upon application of a person engaged in navigation of the harbor under the master's charge. Owners or occupants of land adjoining any navigable waters, except New Haven and Bridgeport harbors, may dig channels to give vessels free access from wharves or piers on their land to the main channel. No interference with, or obstruction on, land bordering navigable waters will be permitted where the public has the right of access unless the landowner has given permission or there is other legal right to do so. (Kelly-Fla)
W69-07275

HARBORS AND RIVERS ACT OF CONNECTICUT.
Conn Gen Stat Ann secs 15-1 to 15-7 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *Navigable waters, *Harbors, Coastal structures, Piers, Docks, Piles (Foundations), Navigation, Coasts, Channels, Ships, Boats, Legal aspects, Legislation, Regulation.

The governor of Connecticut is authorized to appoint a harbor master and a deputy harbor master for each of the harbors of New Haven, Norwich, Bridgeport, Stamford, Norwalk, Stonington, New London, and Branford for terms of three years. Other harbor masters and deputies may be appointed for any town having navigable waters within its limits. Deputy harbor masters have all the powers of harbor masters in the harbors to which they are appointed, subject to the control and direction of harbor masters. Jurisdictions of the harbor masters for Branford and New Haven are extended to adjoining waters. Fines are prescribed for vessels unnecessarily moored in the New Haven channel so as to obstruct the free passage of vessels. The Bridgeport Harbor Master is responsible for supervision of the harbor, tidewaters, all flats and lands flowed thereby, and for removal of obstructions which may interfere with navigation, cause injury to channels, or reduce tidewaters. The harbor master must approve construction of bridges, wharves, piers, dams, fills, or any driving of piles below the high water mark. Unapproved construction shall be deemed by the master a public nuisance, subject to appeal. (Kelly-Fla)
W69-07276

HARBORS AND RIVERS ACT OF CONNECTICUT.
Conn Gen Stat Ann secs 15-1 through 15-26 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *Navigable waters, *Navigation, Structures, Harbors, Coastal structures, Boats, Ships, Permits, Channels, Channel flow, Navigable rivers, Piers, Docks, Piles (Foundations), Lighthouses, Water pollution sources, Legal aspects, Legislation, Federal jurisdiction, Coasts, Barriers, Channel flow, Landfills.

The Harbors and Rivers Act of Connecticut provides that harbor masters for specified state harbors and other navigable waters will be selected by the governor. The duties and powers of the harbor masters and their deputies are set forth, and provision for appeal from their decisions is made. Penalties for disregarding directives given by the masters are established. The statute further provides for the qualifications and licensing of pilots for vessels within the navigable waters of the state. Depositing and dumping in navigable waters is generally prohibited by the statute and penalties are provided. (Kelly-Fla)
W69-07277

HARBORS AND RIVERS ACT OF CONNECTICUT.
Conn Gen Stat Ann secs 15-17 to 15-26 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *Harbors, *Navigable waters, Navigation, Navigable rivers, Piers, Docks, Piles (Foundations), Landfills, Legal aspects, Legislation, Water pollution sources, Coastal structures, Channels, Barriers, Boats, Ships.

Proprietors or charterers of steamers or other vessels will be subject to fines if furnace refuse from their vessels is thrown into any harbor or river of the state. Obstructions or structures placed in New Haven Harbor without the consent of the board of harbor commissioners may be removed by the board at the owner's expense if the latter fails to remove it under the board's order. No wharf, pier, or other structure may be constructed in specified areas of New Haven Harbor. A party contesting an order by the New Haven Board regarding construction or filling in the harbor may appeal the order to the court of common pleas of New Haven County. Dumping of any substance, except oyster shells, in New Haven Harbor, or near its mouth, is prohibited. Dumping is also disallowed in other harbor areas specified by the statute. Fines will imposed for removal or destruction of a authorized buoy, beacon or floating guide in t waters of Connecticut. Mooring or attaching a vessel to such marker is also prohibited. Loc agents of foreign vessels must meet state residen requirements. (Kelly-Fla)
W69-07278

SEWAGE TREATMENT.
W Va Code Ann secs 16-12-5, 16-12-6 (1966), amended, (Supp 1968).

Descriptors: *West Virginia, *Public healt *Sewage disposal, *Sewage districts, Legislatic Sewage, Municipal wastes, Cities, Pumping plan Sewage treatment, Sewers, Water pollutio sources, Septic tanks, Environmental sanitatio Water pollution treatment, Channels, Draina systems, Drains, Social aspects, Wildlife, Water p rification, Water quality, Water quality contr Lakes, Watercourses (Legal), Water supply, Co struction, Water delivery, Administrative agencie Structures, Boundaries (Surfaces).
Identifiers: Penalties (Criminal).

The board of trustees of any sewage district has t authority to construct and defray costs of providi for the disposal of sewage and drainage within t district. The board is charged with protecting t water supply from contamination and for that pu pose may build and maintain a sewage treatme plant together with any other appurtenances nece sary to achieve that purpose. The works establish by the district must serve and benefit the entire te ritory within the district. Nothing in this artic shall limit the power of municipalities within t district to construct their own drains and sewers any structure operated by the district extends ou side the district, the rights and powers of the di trict over that portion shall be the same as tho within the district. The board may treat and puri water which will flow into any watercourse, but may not operate a waterworks for furnishing wat to any municipality. All districts created sha proceed as rapidly as possible to provide sewe and plants to purify water so as to conduce prese vation of public health and render the sewa harmless to animal, fish, and plant life. Any viol tion by the district will be a misdemeanor and a fi will be levied. It is the duty of the state wat resources board or the state department of heal to see that these provisions are carried ou (Shevin-Fla)
W69-07279

NATURAL RESOURCES -- SURFACE MINING

W Va Code Ann secs 20-6-1, 20-6-9, 20-6-11, 2 6-12, 20-6-13 (Supp 1968).

Descriptors: *West Virginia, *Mining, *Natur resources, *Land reclamation, Conservatio Legislation, Administrative agencies, Jurisdictio State governments, Federal government, Permit Soil erosion, Aesthetics, Recreation, Public healt Floods, Land use, Water pollution, Mining e gineering, Land development.
Identifiers: *Surface mining.

The department of natural resources has jurisdi tion and control over all aspects of surface minin especially the restoration of affected areas. It w discovered that surface mining causes soil erosio landslides, flooding, pollution, and destroys th land value for agricultural, recreational, an aesthetic purposes. In addition, it counteracts co servation efforts and impairs the health, safety, an welfare of the public. The director of natur resources may avail himself of the services of an state or federal agency. A surface mining operate is required to prepare a complete reclamation pla and submit it to the director for acceptance. N permit application will be approved if it is felt th the rules and regulations will not or cannot be ob served. Some areas are impossible to reclaim an no mining will be allowed on them. The directo

ay also delete any lands which have been over-
rdened by prior surface mining. He is given con-
derable discretion to prohibit use of certain lands
r surface mining operations. It is the duty of the
ining operator to complete reclamation within
e year after his permit has expired. (Stewart-Fla)
69-07280

ATER POLLUTION CONTROL.
r primary bibliographic entry see Field 05G.
69-07281

ORESTS AND WILDLIFE AREAS.

Va Code Ann secs 20-3-2, 20-3-18 (1966), as
ended, (Supp 1968).

escriptors: *West Virginia, *Flood control,
and management, *Wildlife conservation,
rest management, Legislation, Dams, Adminis-
tive agencies, Conservation, Forests, Road con-
uction, Federal government, Regulation,
vigation, Local governments, Legal aspects.

e director of the wildlife commission may, with
e governor's consent, purchase lands suitable for
te forests or wildlife refuges. He may also use the
ocated funds to construct dams for fish refuges
the acquired lands. Without gubernatorial con-
nt, the director shall pay not more than twenty-
e dollars per acre. He may receive the land as a
t by deed or bequest. The title to all such proper-
shall be in the name of the state. The director
ll protect and maintain the land as forest and
ldlife areas. In addition, he may prescribe and en-
ce rules and regulations concerning hunting and
hing on the property. Money received from the
leral government for flood control or navigation
rposes shall be allocated to the counties. 50% of
ch county's funds shall be transferred to the road
mmission to maintain feeder or state local ser-
ce roads in the counties where floods are located.
tewart-Fla)
69-07282

ATER RESOURCE DEVELOPMENT.
Va Code Ann secs 20-5-1 through 20-5-5
966), as amended, (Supp 1968).

escriptors: *West Virginia, *Administrative agen-
s, *Water resources development, *Water con-
rvation, Legislation, Water pollution, Federal
vernment, State governments, Natural resources,
anning, Water policy, Water supply, Interstate
mpacts, Watercourses, Investigations, Domestic
ter.

e state water resources board, established as a
ccessor to the state water commission, is a public
rporation. It can sue and be sued, contract and
contracted with. The board has jurisdiction over
e Ohio River Valley Sanitation Commission. The
ision of water resources has jurisdiction over the
ministration and enforcement of all laws relating
the conservation, development, protection, and
joyment of the state water resources. The chief
the division of water resources shall investigate
e water resources of the state and study the
oblems of agriculture, industry, conservation,
ter pollution, domestic use, and other problems
ated to water resources. He shall formulate plans
d policies for the preservation of water
sources. The chief is authorized to request infor-
ation from any state agency or political subdivi-
n to help him obtain a more accurate picture. He
y also cooperate with state and federal agencies.
e water resources board has authority to enter
o compacts with neighboring states regarding
mmon watercourses. The board and its
thorized representatives are empowered to enter
y public or private property to conduct surveys
investigations. (Stewart-Fla)
69-07283

POLLUTION ABATEMENT (POWERS AND DUTIES OF DEPARTMENT OF WATER RESOURCES).
For primary bibliographic entry see Field 05G.
W69-07284

MARYLAND DEPARTMENT OF WATER RESOURCES: POWERS AND FUNCTIONS.
Md Ann Code, art 96A:6-9 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Water resources development, *Programs, *Multiple-purpose projects, Legislation, Water resources, Administrative agencies, State governments, Multiple purpose, Project planning, Long-term planning, Boundaries (Property), Investigations, Surveys, Research and development, Research facilities, Tidal waters.

The Maryland Department of Water Resources shall be responsible for supervising and planning the multiple purpose development of state waters, and shall prepare a general water resources program in a manner compatible with multiple purpose management on an appropriate geographical unit basis. The Department is authorized and empowered to make surveys, maps, investigations, and studies of state water resources as it may deem necessary to provide it with sufficient information to formulate a program and to perform its duties. The Department is further authorized to contract for research or scientific investigation with appropriate research organizations. The Department may conduct a joint study with the State Departments of Game and Inland Fish and Chesapeake Bay Affairs in order to define the boundaries of tidal and nontidal waters within state jurisdiction. The boundaries determined shall be set forth in Department regulations. In addition, the Department shall exercise those responsibilities reasonably necessary in carrying out legislative intent. (Wheeler-Fla)
W69-07285

SOIL CONSERVATION.
Conn Gen Stat Ann secs 25-106 to 25-109b (1960), as amended, (Supp 1969).

Descriptors: *Connecticut, *Watershed management, *Flood protection, *Conservation, Legislation, Fish conservation, Wildlife conservation, Water law, Interstate compacts, Recreation facilities, Cities, Agriculture, Governors, Government finance, Multiple-purpose projects, Watersheds (Basins), Cities.
Identifiers: Secretary of Agriculture.

The term 'works of improvement' is defined as any single or multi-purpose undertaking for flood prevention or water conservation which includes fish, wildlife and recreational developments in watershed areas not exceeding 250 thousand acres. A watershed area program may be initiated by the legislative body of any municipality requesting the state commissioner of agriculture to review the plan and obtain assistance from the federal secretary of agriculture pursuant to Public Law 566. The commissioner may acquire lands by purchase or eminent domain and may borrow funds from the secretary of agriculture to finance the local share of costs. The commissioner shall control the construction, operation, and maintenance of such works and improvements and shall retain title to any structure exclusive of recreational, fish, and wildlife developments. The state will absorb the cost of relocating any public service company deemed necessary to accommodate any works of improvement. With approval of the governor, the commissioner of agriculture and natural resources may enter into any interstate compact which will facilitate any works of improvement on streams without the state. Municipalities may acquire part of any works of improvement for park and recreational purposes. (Holt-Fla)
W69-07286

NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMMISSION.
For primary bibliographic entry see Field 05G.
W69-07287

WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W69-07288

WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W69-07289

WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W69-07290

NOTICE; RIPARIAN OWNER AFFECTED BY TAKING OF WATER.

W Va Code Ann sec 54-2-3 (Supp 1968).

Descriptors: *West Virginia, *Riparian land, *Riparian rights, *Condemnation, Legislation, Riparian water loss, Riparian waters, Compensation, Condemnation value, Damages, Land tenure, Adjudication procedure, Appropriation, Water utilization.
Identifiers: *Notice.

If water is to be taken as authorized in Section Ten, Article One of this chapter, notice to all riparian owners below the point at which the water is proposed to be taken, and who are likely to suffer injury as a result of such taking, must be given by appropriate publication throughout the county. Any riparian owner may make himself a party to the proceedings. He is entitled to have his rights passed upon by the commissioner and his damages, if any, ascertained, allowed, and paid. (Shevin-Fla)
W69-07291

BRIDGES.

Minn Stat secs 441.01, 441.15, 441.16, 441.26 to 441.27, 441.46 to 441.48 (1947),as amended, (Supp 1969).

Descriptors: *Minnesota, *Bridges, *Cities, *Construction, Local governments, Navigable waters, Nonnavigable waters, Legislation, Boundaries (Property), Bridge construction, Watercourses, Municipalities, State governments, Administrative agencies, Maintenance, Repairing.

Any first class city is authorized to construct a bridge jointly with another first class city over any natural watercourse forming a boundary between them. Any first class city having navigable waters and under a home rule charter, is authorized to apply to the Secretary of War for the privilege of erecting a public bridge. Any city whose population is less than 20,000 and which is situated on interstate or international waters is authorized and empowered to secure money by bonds or appropriation for the construction and maintenance of bridges over such waters into another state or country. The council of any fourth class city may appropriate reasonable sums to improve and maintain bridges and ferries on roads leading into the city although located outside the county. Any city purchasing any such bridge has power to sell, assign, and transfer it and its approaches to the state or any political subdivision thereof, or any public or state agency. However, any sale or transfer shall not alter or affect the rights, powers, and securities of any bondholders. Any city bordering on navigable or non-navigable waters is authorized to purchase or construct bridges across such waters whether the bridge is within or beyond the city limits. (Stewart-Fla)
W69-07292

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PARK DISTRICTS.
Minn Stat Ann secs 398.01, 398.09, 398.32, 398.34 (2) (1968), as amended, (Supp 1969).

Descriptors: *Minnesota, *Local governments, *Parks, *Administrative agencies, Cities, Land use, Conservation, Natural resources, Recreation, Recreation facilities, Condemnation, Streams, Lakes, Regulation, Federal government, Project purposes, Public benefits, Public health, Mosquitoes, Water pollution, Legislation, Water utilization, Lake shores.

Subject to activation by the Boards of County Commissioners, park districts are created. When activiatied, such districts shall be deemed political subdivisions of the state. The park districts shall be either single or multi-county. The park district boards have the power to regulate the use of any lake waters and shore area in the parks. The board is empowered to acquire lands for conservation of state natural resources including streams, lakes, and submerged lands. The Board does not have the power to acquire land located within the boundaries of a city by purchase or condemnation without prior permission. Neither shall the Board have the power to alter, fix, or charge fees for use of the park. The Board shall not cooperate with or borrow from any state or federal organization. The Board has no authorization to cooperate with any city, county or private organization engaged in conservation, recreation, prevention of water pollution, protection of public health and safety, or mosquito abatement. Any county may acquire any land or water areas deemed useful for public park purposes. The county board may prescribe regulations for protection and use of any parks including waters lying within such park. (Stewart-Fla)
W69-07293

WATER POLLUTION CONTROL; SANITARY DISTRICTS WATER POLLUTION CONTROL ACT.
For primary bibliographic entry see Field 05G.
W69-07294

POLLUTION CONTROL AGENCY.
For primary bibliographic entry see Field 05G.
W69-07295

WATERS AND WATER CRAFT SAFETY.
Minn Stat, secs 361.01 to 361.29 (1966), as amended, (Supp 1969).

Descriptors: *Minnesota, *Permits, *Equipment, Boats, Safety, Water skiing, Legislation, Pollution, Abatement, Water sports, Navigation, State governments, Beaches, Taxes, Foreign countries, Navigable waters, Structures, Financing, Administrative regulation.
Identifiers: Marine toilets, Penalties, Crimes.

All watercraft operated within the state must be licensed. Licensing provisions and fees are set out. Operating regulations including speed, methods of operation, places of operation, water skiing and touring requirements, prohibitions against operating watercraft while intoxicated and accident reports are provided. Equipment requirements are listed. Violation of regulations or equipment requirements is a misdemeanor. The county sheriff has the duty of enforcing the regulations of this chapter. License fees under this chapter shall be paid into the boat and water safety account hereby created. Fines shall be paid the county treasury. Provisions for use of marine toilets are set out. (Kahle-Fla)
W69-07296

WATERS AND WATERCRAFT SAFETY.

Minn Stat sec 361.03 (1966), as amended, (Supp 1969).

Descriptors: *Minnesota, *Permits, Boats, Ships, Legislation, Federal government, State governments, Foreign countries, Navigation, Navigable waters, Taxes, Regulation.

Any watercraft operated within this state must be licensed. Application for license must be made to the commissioner or county auditor according to his regulations. The fees for a license for one calendar year are as follows: (a) rented watercraft 75 cents; (b) watercraft 16 feet or under 75 cents, and an additional 25 cents per foot over 16 feet; (c) dealer's license $5 regardless of the number of craft. Duplicate licenses may be obtained for 75 cents. Licenses expire on December 31 of each year. Licenses shall be issued to stateowned craft without a fee. No license is required for the following craft: (a) craft federally licensed or licensed by another state which have not been in the state for 90 consecutive days; (b) watercraft from another country temporarily using state waters; (c) watercraft owned by the United States or a state; (d) a ship's lifeboat; or (e) craft which have a valid marine document issued by the federal bureau of customs. No political subdivision of the state shall require a watercraft license. (Kahle-Fla)
W69-07297

WATERS AND WATERCRAFT SAFETY.
Minn Stat secs 361.04 to 361.13 (1966), as amended, (Supp 1969).

Descriptors: *Minnesota, *Boats, *Safety, Water skiing, Water sports, Navigation, Navigable waters, State governments, Legislation, Beaches, Regulation.
Identifiers: Obstruction to navigation.

The operation of watercraft at excessive speed or in a careless manner is a misdemeanor. Reckless operation causing injury or property damage is punishable by a fine of not more than $100 and/or imprisonment not to exceed 90 days. Operating watercraft so as to obstruct navigation or the placing of structures on water for advertising are prohibited. No watercraft may be operated in areas set aside for bathing. No person may operate a watercraft towing a person on skis or other devices without another person in the boat to observe the skier or without being equipped with a curved rearview mirror to observe the skier. No watercraft shall be operated when loaded beyond its safe capacity or equipped with a motor beyond its safe power capacity. It is unlawful to ride on the gunwales or bow of a boat under 26 feet unless the boat is equipped with adequate safety railing. No person shall operate a watercraft while under the influence of alcohol. An operator involved in an accident must render assistance and promptly report the accident to the sheriff. Where penalty is not specifically set out, violation shall be a misdemeanor subject to $100 fine and/or 90 days imprisonment. In addition, violators may be prohibited from operating a watercraft for 90 days. (Kahle-Fla)
W69-07298

WATERS AND WATERCRAFT SAFETY.

Minn Stat secs 361.14 to 361.27 (1966), as amended, (Supp 1969).

Descriptors: *Minnesota, *Boats, *Ships, *Safety, Equipment, Legislation, State governments, Local governments, Navigation, Navigable waters, Structures, Financing, Regulation.

Rental watercraft shall have available life preservers complying with Coast Guard regulations if the county board approves such regulation. Watercraft under 26 feet must carry a light visible for 2 miles. Craft over 26 feet must comply with Coast Guard lighting regulations. Boats over 26 feet must carry a horn or whistle audible for at least 1/2 mile. No siren shall be carried by other than patrol boats. All craft must be equipped with a muffler. No motor other than an outboard shall be used without a device for arresting backfire. Boats using fuel must be equipped with a fire extinguisher. Races or hibitions must have approval of the county she Permits from the commissioner are required structures which may constitute navigatio hazards. No person shall tamper with a navigatio aid. Violations of the above provisions are punis ble by $100 fine and/or 90 days imprisonment addition violators may be prohibited from ope ing a watercraft for 90 days. The sheriff shall force provisions of this chapter and maintai search and rescue program. County boards sh propose budgets for carrying out provisions of t chapter which shall be incorporated into budget of the department of conservation subj to the commissioner's approval. License fees sh be paid into the boat and water safety acco hereby created. Fines shall be paid to the cou treasury--one half to be applied to county reve and one half to the boat and water safety accou (Kahle-Fla)
W69-07299

WATERS AND WATERCRAFT SAFETY.
Minn Stat sec 361.29 (1966), as amended, (Su 1969).

Descriptors: *Minnesota, *Pollutants, *Pollut abatement, Boats, Ships, Navigable waters, P mits, Legislation, State governments, Regulation Identifiers: Marine toilets, Human excrements.

No person operating a watercraft shall permit use of a marine toilet unless it is equipped wit treatment device acceptable to the water pollut control commission of the state. No person sh discharge untreated sewage or other waste into waters of the state. The water pollution con commission shall furnish a list of acceptable ma toilets. After April 1, 1966 no craft shall equipped with any marine toilet unless accepta to the commission. Presence of a marine toilet m be indicated upon application for licensing and license shall be issued except upon certification the owner of installation of an acceptable tr ment device. (Kahle-Fla)
W69-07300

HANCOCK V PIPER (CONSTRUCTION OF DRAINAGE CANAL).

219 So 2d 746-48 (2d DCA Fla 1969).

Descriptors: *Florida, *Drainage, *Road constr tion, *Condemnation, Canals, Right of way, Ea ments, Engineers, Ditches, Damages, Constructi Legal aspects, Judicial decisions, Local gove ments, Contracts.
Identifiers: Inverse condemnation, Considerati Failure of consideration.

Appellees, on request of the county, execute quit claim deed granting the county a 100 foot ri of way through their property for the purpose building a shallow canal for drainage, to be c structed in connection with a proposed road. county constructed the road but did not comp construction of the drainage canal. The prop owners brought an action against the county fo failure to complete the drainage canal. The c held that the complaint filed by the appellees broad enough to support the decision reached the trial judge. The court further held that c sideration had existed, but that there had bee failure of consideration. The court held that trial judge properly tried the case under the the of inverse condemnation and upheld that de mination. (Shevin-Fla)
W69-07301

USSERY V ANDERSON-TULLY CO (OWNE SHIP OF LAND FORMED BY ACCRETION).

122 F Supp 115-133 (E D Ark 1954).

Descriptors: *Accretion (Legal aspects), *L tenure, *Navigable rivers, *Bank erosion, Alt

n of flow, Avulsion, Judicial decisions, Arkansas, ver beds, Maps, Charts, Lakes, Channels, Ripari- lands, Migration, Lumber, Banks, Navigable ters, Land forming, Boundaries (Property), ores, Legal aspects.
ntifiers: *Arkansas River.

e plaintiff brought suit to quiet his title to certain d formed by accretion. The defendant counter- imed to quiet his title. The defendant owned operty on the north bank of the river while the intiff's property was on the south side. The cru- l issue to be resolved was which bank of the river s the source of the accretion. The plaintiff con- ded that the land in question was an accretion to property but was subsequently cut off by avul- n. Of great persuasive value during the court's liberations was the physical evidence on the und and certain evidence demonstrating the wth pattern of timberlands. Also relying on vernment surveys, the court found that the river grated southward, destroying the south bank by sion. The result of the migration and erosion s the formation of the accretion on the north nk. On the basis of this analysis, the court de- ed in favor of the defendant and quieted title in n. (Stewart-Fla)
69-07302

LF ATLANTIC TRANSPORTATION CO V CKER COUNTY SAND AND GRAVEL CO IT FOR DAMAGES CAUSED BY SHOAL IN VIGABLE RIVER).

2 F Supp 13-19 (E D N C 1954).

scriptors: *North Carolina, *Navigation, hoals, *Navigable waters, Admiralty, Gravels, allow water, Navigable rivers, Obstruction to w, Streams, Sands, Silts, Judicial decisions, gal aspects, Damages.
ntifiers: *Barges, Obstruction to navigation.

intiff barge owner brought suit in admiralty ainst defendant sand and gravel company to cover for damages caused when a barge struck a oal near a point on a river on which defendant intained a gravel washing plant. Plaintiff ablished that this shoal was formed by sand and which was deposited into the river by defen- nt's plant and that defendant was well aware of s shoaling process, having received notification such by the U S Engineers. With this in mind, the urt ruled that, since any unreasonable or authorized obstruction of a navigable stream is lawful and constitutes a nuisance, this shoaling s such a nuisance, and plaintiff, who sustained ury to his barge as a proximate result of this ob- uction, was entitled to recover damages which incurred. (Logan-Fla)
69-07303

YANT V CHICAGO MILL AND LUMBER CO IT TO QUIET TITLE TO ACCRETED PRO- RTY).

0 F Supp 463-478 (E D Ark 1954).

scriptors: *Arkansas, *Mississippi River, treams, *Accretion (Legal aspects), Boundaries roperty), Bank erosion, Riparian lands, Riparian hts, Proprietary powers, Prescriptive rights, mages, Remedies, Judicial decisions, Legal ects, Navigable rivers, Navigable waters.

intiffs brought suit to quiet title to accreted ds, claiming title thereto under a tax deed. The fendants asserted title to the land under various corded conveyances and by virtue of tax pay- nts made by themselves and their predecessors title. The court determined that the common decessor in title of both parties owned the lands question on both sides of the stream and had sold property on each side to separate persons. Each nveyance carried with it the accretions on the spective stream bank. Subsequent to the verance of the parcels from their respective accretions, a tax delinquency precipitated a tax sale of the mainland tract and its accretions. This property was purchased by plaintiffs at the sale. The court held that the plaintiffs were seized only of the mainland property and its accretions, finding that the severance of the parcels extinguished any rights the mainland tract owner might assert against accretions located to the east of the stream. (Katz-Fla)
W69-07304

THE DEVELOPMENT OF INTERNATIONAL WATER RESOURCES: THE 'DRAINAGE BASIN APPROACH',
C. B. Bourne.
The Canadian Bar Review, Vol 47, No 1, pp 62-87, March 1969. 26 p, 80 ref.

Descriptors: *Watersheds (Basins), *International law, *Water resources development, *River basins, Water utilization, Water policy, Planning, Basins, Drainage, Watersheds (Divides), Drainage effects, Watercourses (Legal), Water conservation, Water demand, Water resources, Diversion, Water law, Water allocation (Policy), Governments, Watershed management, Withdrawal, United Nations, Political aspects, International waters.

As the interdependence of co-basin states became clearer, it was recognized that international law required the development of the basin as a unit. Most authorities on international law acknowledge that unified development is desirable but deny that it is required by international law. Those who support the development of a drainage basin as a unit are influenced by the physical and economic unity of the basin. But the ability of modern technology to effect trans-basin diversions of waters has reduced the physical unity of many basins, and the development of efficient overland transportation has reduced their economic unity. Since the waters of a river may now serve a much larger population than that of its drainage basin, an approach which takes into account the most beneficial use of the water, whether inside or outside of its drainage basin, would make possible the most rational use of the waters. (Gabrielson-Fla)
W69-07305

PRIVATE LANDS AND WATERS, PUBLIC USE.
Minn Stat, secs 87.01 to 87.04 (1964).

Descriptors: *Minnesota, *Public health, *Public benefits, *Recreation facilities, Legislation, Recreation, Boating, Camping, Ice skating, Skiing, Water skiing, Fishing, Swimming, Water sports, Hunting, Land use, Parks, Recreation demand, Social aspects, Access routes, Roads, Waterway, Damages, Public rights.
Identifiers: Trespass.

State policy calls for the encouragement of the use of privately-owned lands and waters for public recreational facilities. Outdoor recreational use includes hunting, fishing, boating, swimming, skiing and other pursuits for the purpose of outdoor recreation. A free recreational area is a privately-owned area which the owner has made available to the public for recreational uses without compensation. The owner can make his land available by either executing a declaration stating his desire to do so, filed with the office of the register of deeds, or by posting notice on the land itself. No dedication of any land for recreational use shall take place except at the instance of the owner. No liability for damages to person or property occurring on a free recreational area shall lie against the owner except as could be maintained by a tresspasser. (Shevin-Fla)
W69-07306

BANKS V TOWN OF BURNSVILLE (SUIT TO ENJOIN CITY FROM EMPTYING SEWAGE INTO STREAM).
For primary bibliographic entry see Field 05G.
W69-07307

PARMELE V EATON (SUIT TO DETERMINE NAVIGABILITY OF WATER COVERING PROPERTY SUBJECT OF PURCHASE).

240 NC 539, 83 SE 2d 93-99 (1954).

Descriptors: *North Carolina, *Coastal marshes, *Nonnavigable waters, *Beds, Swamps, Tidal marshes, Land reclamation, Shallow water, Guts, Tidal waters, Navigation, Boats, Commercial fishing, Legal aspects, Judicial decisions, Watercourses (Legal), High water mark, Navigable waters, Real property.
Identifiers: Marketable title, Contract of sale.

Plaintiff vendor sued defendant vendee for specific performance of a contract to sell certain real property. Plaintiff had tendered a deed and defendant had refused to accept it, alleging that title was unmarketable in that the land was covered by navigable waters and thus not subject to grant by the state or sale by the State Board of Education (plaintiff's predecessor in title). The appellate court, in affirming the trial court, ruled for plaintiff. The court felt that the evidence sustained the finding that the water covering this 2,000 acre tract of marsh land was not navigable. Ignoring the ebb and flow of the tide as criterion for determining navigability, the court felt the more practical test to be whether, in its ordinary state, a body of water has capacity and suitability for the usual purpose of navigation by vessels or boats such as employed in the ordinary course of water commerce, trade, and travel. The rule accepted by the court was that all watercourses are regarded as navigable in law which are navigable in fact. (Logan-Fla)
W69-07308

POTEETE V CITY OF WATER VALLEY (SUIT FOR DAMAGES RESULTING FROM DIVERSION OF SURFACE WATER).

42 So 2d 112-116 (Miss 1949).

Descriptors: *Mississippi, *Road construction, *Surface drainage, *Diversion, Surface runoff, Surface waters, Ditches, Drainage, Embankments, Levees, Cities, Local governments, Alteration of flow, Judicial decisions, Legal aspects, Relative rights.

Plaintiff landowners brought suit to recover for damages resulting from work done on an adjacent street. Plaintiffs contended this construction diverted the surface water from the street onto their residence lot. The trial court instructed the jury that it was plaintiffs' duty to do all in their power to mitigate damages, and, thus, they should recover no damages for those injuries which could have been prevented by ditching or levying. On appeal, the court declared this instruction to be invalid on two grounds: (1) the plaintiffs (abutting owners) had no legal right to go into the city's street and reopen the ditch or build a levee or embankment without defendant's consent; (2) defendant offered no evidence showing that plaintiffs could have avoided the damage by doing such work on his own property. Therefore, the case was reversed and remanded to the trial court. (Logan-Fla)
W69-07309

HUERTH V TOWN OF PRAIRIE DU SAC (ROAD CONSTRUCTION OBSTRUCTING SURFACE WATER FLOW).
252 Wis 102, 31 NW 2d 187-189 (1948).

Descriptors: *Wisconsin, *Surface drainage, *Road construction, *Natural flow, Roads, Culverts, Outlets, Drainage systems, Rivers, Hay, Crops, Floodwater, Overflow, Ditches, Conduits, Drainage engineering, Obstruction to flow, Surface runoff, Surface waters, Percolating water, Marshes, Local governments, Judicial decisions, Legal aspects.
Identifiers: *Residual flood waters, Seasonal floods.

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Plaintiff landowner brought suit against defendant town for damages resulting from town's failure to provide adequate drainage for surface and percolating waters in the construction of two roads intersecting near the corner of plaintiff's land. Plaintiff contended that this intersection forms a dyke which blocks the natural drainage of surface waters from his land in violation of statute. The issue was whether the flow obstructed was in fact a natural flow of drainage water. The court held that even though plaintiff had collected the surface and percolating waters into a drainage ditch, this ditch merely accelerated the movement of surface water in the direction of natural drainage. Obstruction of this ditch was therefore an illegal obstruction. The court further held that while a town does not have to provide for drainage through the path of seasonal flood waters, the statute does require them to provide for adequate drainage of residual flood waters in that these are considered to be surface waters. (Logan-Fla)
W69-07310

MACNEIL V CHICAGO PARK DISTRICTS (SUIT TO ENJOIN COLLECTION OF HARBOR FEES BY MUNICIPALITY).

401 Ill 556, 82 NE 2d 452-456 (1948).

Descriptors: *Illinois, *Harbors, *Navigable waters, *Local governments, Lake Michigan, Submerged Lands Act, Lake shores, Lagoons, Marinas, Beds, Boats, Ownership of beds, Parks, Legislation, State governments, Federal government, Judicial decisions, Legal aspects.
Identifiers: *Harbor fees, Delegation doctrine.

Plaintiff boat owner brought suit to enjoin the defendant Chicago Park District from collecting harbor fees for use of harbor facilities (docking, mooring, etc) on the grounds that harbors are public, navigable waters and, therefore, usable by members of the public free of charge. The court noted two primary issues: (1) whether the fee prescribed by the ordinance is an unconstitutional exercise of municipal authority over navigable waters; and (2) whether the state delegated such power to impose a fee to the Park District. As to the first issue, the court held this was neither an unconstitutional exercise of municipal authority over navigable waters nor an interference with interstate commerce. As to the second, the court found the Illinois statutes provided that submerged lands should be held for the purpose of constructing and maintaining lagoons and harbors for boats, and the establishing and maintaining of regulations for use thereof by the public. The court held this empowered the defendant to establish fees for the use of such special facilities. The court thus affirmed the dismissal of the complaint. (Logan-Fla)
W69-07311

SLAGLE V CITY OF EAST LIVERPOOL (SUIT FOR WASHOUT DAMAGES AND POLLUTION ABATEMENT).

86 NE 2d 37-39 (Ohio Ct App 1948).

Descriptors: *Ohio, *Washouts, *Dredging, *Pollution abatement, Water pollution, Public health, Stagnant water, Odor, Water pollution effects, Channel improvement, Natural streams, Running waters, Watercourses (Legal), Sewage, Obstruction to flow, Culverts, Pipes, Judicial decisions, Legal aspects.

Plaintiff landowners brought suit against defendant city to recover for damages resulting from defendant's dredging and deepening of a watercourse on plaintiffs' property and to abate a nuisance created by rubbish and debris being thrown into this natural watercourse, obstructing the flow and causing the water to become stagnant. It appeared from the evidence that defendant had gone ahead with the dredging of this open, natural watercourse without permission of plaintiffs and that this resulted in a $200.00 loss of land to plaintiffs. In regard to the alleged nuisance, the evidence showed heavy accumulation of waste material in the watercourse; the city was admittedly aware of this condition. The court affirmed the trial court's verdict for the plaintiffs. Concerning the nuisance, however, the court ruled that the trial court had the power to order abatement but not the power to prescribe the manner in which it was to be abated. (Logan-Fla)
W69-07312

UNITED STATES V MARTIN (TITLE TO LAND FILL).
177 F 2d 733-734 (D C Cir 1949).

Descriptors: *District of Columbia, *Riparian rights, *Landfills, *Boundaries (Property), Navigation, Relative rights, Ownership of beds, Riparian land, Accretion (Legal aspects), Federal government, Legislation, Rivers and Harbors Act, Bulkhead line, Piers, Docks, High water mark, Legal aspects, Judicial decisions.

The United States brought suit against certain landowners to establish its title to partially submerged land along the eastern branch of the Potomac River. Defendants are riparian owners who, by natural accretion and much artificial fill, have extended their land into the river beyond the original high water mark established in 1794. Since then, the government has established a bulkhead line some 300 feet beyond the high water mark. Some lots have now been filled up to the bulkhead line, and one wharf has been extended beyond it. The case turned upon ownership of land situated beyond the old high water mark. The court held that an owner of riparian land has the qualified right to make fills and to build wharves in the river, but the exercise of such right does not affect the power of the United States with regard to navigation. That is, the fill and wharf involved could be taken at any time without compensation in the interests of navigation, provided the taking was not arbitrary. (Logan-Fla)
W69-07313

STATE OF WISCONSIN V FEDERAL POWER COMMISSION (NAVIGABLE RIVERS).
214 F 2d 334-338 (7th Cir 1954).

Descriptors: *Wisconsin, *Navigable rivers, *Federal power act, *Federal-state water rights conflicts, Federal government, Navigable waters, Running waters, Streams, Lumbering, Supercritical flow, Administrative agencies, Interstate rivers, Mississippi River, Surface waters, Judicial decisions, Legal aspects.
Identifiers: Saw-log test.

The Federal Power Commission, in granting a project license to a power and light company, had ruled that a certain river was navigable. The Public Service Commission of Wisconsin brought suit to review this order contending that this river was not navigable in that no logs had been transported thereon since 1924. The court first took notice that prior to 1924 this river had been used extensively to transport logs from one state to another. The court held that under both state law (saw-log test of navigability) and federal law (streams suitable for use in the transportation of persons or property in interstate commerce) the east fork of the Chippewa River was navigable and subject to commission control. The fact that the river had not been used for the transportation of logs since 1924 was of no consequence. (Logan-Fla)
W69-07314

NAMEKAGON HYDRO COMPANY V FEDERAL POWER COMM'N (APPLICATION FOR LICENSE UNDER THE FEDERAL POWER ACT).

216 F 2d 509-513 (7th Cir 1954).

Descriptors: *Wisconsin, *Hydroelectric project licensing, *Federal Power Act, *Recreation, Boating, Fishing, Lakes, Rivers, Aesthetics, Reserv
Dams, Scenery, Tourism, Wild rivers, Conse
tion, Hydroelectric plants, Electric power, L
aspects, Judicial decisions, Relative rights,
ministrative agencies.
Identifiers: Substantial evidence rule, Finding
fact, Right to hearing.

This proceeding provided a review of an orde
the Federal Power Commission denying
tioner's application for a license to construct a
and hydroelecric project on the Namekagon Ri
In its decision, the court first took note that ur
the Federal Power Act it is solely within the c
mission's discretion as to whether a license sh
be granted. Of course, the commission's find
must have a rational basis in fact and be suppo
by substantial evidence. The court upheld the c
mission's denial, agreeing with the commission
the unique recreational features of the river
miles of free flowing water for fishing, canoe
sightseeing, etc) were of greater public benefit t
use of the river for water-power development.
evidence presented by petitioner tended to sl
that the dam, if constructed, would creat
flowage suitable for both fishing and boating. S
conditions would be comparable to facilities
ready available in 85 other lakes within a 10
radius of the dam site. Therefore, the gains to
derived from the proposed construction were
sufficient to compensate for the resultant los
this natural river as a unique recreational
tourist attraction. (Logan-Fla)
W69-07316

**UNITED STATES V ROSS (CRIMIN
PROSECUTION BASED UPON NAVIGABIL
OF WATER).**

74 F Supp 6-9 (E D Mo 1947).

Descriptors: *Missouri, *Borrow pits, *Naviga
waters, *Federal jurisdiction, Drainage distr
Levees, Federal government, Hunting, Boats, N
navigable waters, High water mark, Legislat
Docks, Rivers, Legal aspects, Judicial decisi
State jurisdiction, Safety, Hazards.
Identifiers: Penalties (Criminal).

Defendant was charged in a criminal informa
with operating a motor boat in a reckless
negligent manner endangering the lives of oth
The main issue was whether the act took place
navigable waters so as to allow the federal gov
ment to prosecute the suit. Citing appropr
authority, the court ruled that navigability depe
on whether the waters are navigable in fact. Wa
are navigable in fact when they are used, or
susceptible of being used in their ordinary co
tion, as highways for commerce on which trade
travel are or may be conducted. The mere abilit
cause a small boat to float upon a watercours
high water or to push or pole a small boat thro
that water does not render such water body nav
ble. Therefore, the court held the 'borrow pit' (a
from which soil had been taken to build a le
wherein the defendant's acts had taken place w
nonnavigable body of water and, therefore, that
federal government had no jurisdiction over the
fense in question. (Logan-Fla)
W69-07317

**GEIGER V CITY OF NEW YORK (DAMA
FROM STORM SEWER INSTALLATION).**

141 NYS 2d 667-670 (N Y Sup Ct 1955).

Descriptors: *New York, *Storm drains, *Drain
effects, *Road construction, Grading, Drainage
gineering, Sewers, Surface runoff, Surf
drainage, Surface waters, Paving, Graded, Nat
flow, Cities, Local governments, Legal aspects,
dicial decisions, Overflow, Damages.

Plaintiff property owners filed suit against the
to enjoin maintenance of an alleged nuisance
compel its abatement, and to recover damages.

t was precipitated by installation of a storm ver which required the street to be raised to a el above that of adjacent sidewalks. This caused ter to run off the street onto plaintiffs' property. e court, noting that the present grade was still ow the legal grade, reiterated the rule that when re is a change of grade, in the absence of gligence, the resulting damages to real property tting the newly graded street are damnum sque injuria in the absence of legislation horizing recovery for such damages. Finding no dence of negligence, the court dismissed the t. Furthermore, the court held that the city was der no duty to furnish drainage systems for water urally collected in the street and that a city can- be held liable for damage occasioned by the ural flow of surface water. (Logan-Fla)
9-07318

THORN V BOARD OF COMMISSIONERS EVEE MAINTENANCE).

8 So 2d 335-341 (3rd C C A La 1969).

scriptors: *Louisiana, *Levees, *Flood protec- n, *Riparian land, Navigable rivers, Streams, yous, Appropriation, Flood control, Drainage tems, Public benefits, Overflow, Cattle, Legal ects, Judicial decisions, Riparian rights, Ad- nistrative agencies.
ntifiers: *Fences, *Levee servitude, Cattle rds, Injunctions (Prohibitory).

evee board adopted a resolution requiring lan- wners to remove fences along the levee crown ess cattle gates were installed. The landowners d to enjoin the levee board from enforcing the olution. The court noted that the public enjoyed ervitude for the making and repairing of levees land adjacent to navigable rivers and streams. arian lands are regarded as burdened with this vitude at the time they are severed from the blic domain. The landowners are regarded as ding subject to this servitude, and due process es not protect riparian owners from appropria- n or damage to their lands for levee purposes hout prior judicial proceedings. The actions of a blic agency in locating, building, and maintain- a levee are not subject to judicial review except the case of palpable abuse. The court cannot stitute its own judgment for that of the state's ee board which is responsible for protecting the blic from floods. The public's levee servitude is ited only by the reasonableness of its use. The rt held that it was not an unreasonable deter- nation by the board that the fences created an tacle to the performance of its duties and that levee board has a right to require landowners to ove their fences as obstacles to the main- ance of the levee. (Shevin-Fla)
9-07320

ODWARD IRON CO V EARLEY (SUIT AINST MINE OPERATOR FOR LOSS OF LL WATER).

So 2d 267-270 (Ala 1946).

criptors: *Alabama, *Mining engineering, ater wells, *Water loss, Wells, Deep wells, Un- ground, Percolating water, Subsurface waters, colation, Mining, Coal mines, Shafts (Excava-), Damages, Leakage, Legal aspects, Judicial isions, Drainage.
ntifiers: 'Squeeze', Superjacent owner.

ntiff superjacent landowner brought suit inst defendant mining company alleging that ligence in the operation of a mine caused plain- s well to go dry. Plaintiff's testimony, as well as of expert witnesses, revealed that defendant's ing techniques, which included leaving an in- icient number of pillars within the mine, led to a eeze' which caused cracks to form towards the ace, draining water from adjacent wells. The rt stated that a mine operator is not liable for in- ntal damages (such as loss of a well by the su- acent owner) necessarily occasioned by the ordinary, careful operation of the mine in a manner not injurious to the surface. But, the court added, the issue of failure to exercise due care is a jury question and was therefore properly submitted to the triers of fact for determination. Furthermore, the evidence was sufficient to support a finding that defendant had in fact negligently operated the mine. But the court considered the lower court's award of $1200 damages as excessive and required remittitur. (Logan-Fla)
W69-07321

CITY OF WEST FRANKFORT V FULLOP (SUIT TO ENJOIN DRILLING AND OPERATION OF GAS AND OIL WELLS).

For primary bibliographic entry see Field 05G.
W69-07322

STATE V PINDER (ACTION TO REMOVE AN OBSTRUCTION FROM A DRAINAGE DITCH).

41 So 2d 479-485 (La Ct App 1949).

Descriptors: *Louisiana, *Surface drainage, *Relative rights, *Obstruction to flow, Surface waters, Surface runoff, Rainwater, Judicial decisions, Civil law, Natural flow, Drainage systems, Drainage water, Ditches, Drains, Controlled drainage, Drainage effects, Prescriptive rights, Riddance (Legal aspects), State governments, Local governments, Drainage engineering, Remedies.
Identifiers: Injunctions (Prohibitory).

Plaintiff brought this suit to have defendant enjoined from obstructing a drainage ditch. Plaintiff and defendant owned abutting lots; defendant's land was lower than plaintiff's. Over twenty years prior to this action, the city had constructed a drainage ditch across plaintiff's land and alongside defendant's property. Prior to the time when defendant became owner of the adjacent plot, plaintiff laid a pipe in the ditch crossing his land and covered the ditch over. The pipe ended eighteen inches from defendant's property. Plaintiff alleged that defendant had filled up the ditch on the side of his land and had placed an obstruction near the end of the drainage pipe which had caused water to back up on plaintiff's land. The court held that the defendant had wrongfully filled in the ditch. Since the ditch had been used for over ten years, it had become a continuous apparent servitude acquired by prescription. Defendant also acted wrongfully in obstructing the flow of water from the drainage pipe. The landowner whose waters flow naturally over another's land, may concentrate and increase the flow artificially provided he has drained only the water which normally flows across the other's land. Defendant could not impede the drainage onto his land without a showing that the drain added water to the natural quantity of water flowing across his land. (Kelly-Fla)
W69-07323

JONES V WALKER (ACTION TO ENJOIN MAINTENANCE OF AN EMBANKMENT).

44 So 2d 466-467 (Miss 1950).

Descriptors: *Mississippi, *Surface drainage, *Natural flow, *Alteration of flow, Storm runoff, Surface runoff, Relative rights, Judicial decisions, Surface waters, Rainwater, Rainfall-runoff relationships, Drainage engineering, Natural streams, Embankments, Flood damage, Drainage effects, Drainage systems, Remedies, Riddance (Legal aspects), Repulsion (Legal aspects), Flow augmentation, Diversion structures.
Identifiers: Injunctions (Prohibitory).

Plaintiff brought this suit to have defendant enjoined from maintaining a small embankment which caused water to flow into a natural stream. Plaintiff and defendant owned lands on opposite sides of a natural creek. In times of heavy rain, a natural hollow on defendant's land caused surface water to collect and overflow onto his cultivated fields. Defendant constructed an embankment on his land which caused waters in the hollow to flow into the creek instead of onto his land. Plaintiff contended that the embankment caused an excessive amount of water to flow into the creek so as to overflow plaintiff's land. The court held that since the embankment had the effect of causing the surface water to flow into the creek, a natural watercourse, and since it was not erected for the purpose of diverting a natural watercourse, it was a lawful protection of defendant's lands and plaintiff was not entitled to injunctive relief. (Kelly-Fla)
W69-07324

METROPOLITAN DISTRICT ACT.

Mich Comp Laws Ann secs 119.1, 119.1a, 119.2 (1967), as amended, (Supp 1968).

Descriptors: *Michigan, *Public utility districts, *Water supply, *Sewage disposal, Drainage, Cities, Legislation, Parks, Public utilities, Contracts, Transportation, Operations, Legal aspects.
Identifiers: *Incorporation, *Elector approval, *City boundaries.

Any two or more cities, villages or townships may incorporate into a metropolitan district to acquire and operate parks or public utilities for supplying sewage disposal, drainage, water or transportation within or without their limits. Any such district may sell or purchase within or without its limits any rights or facilities listed above, and may succeed to such rights and facilities of any municipality. No municipality shall surrender rights, obligations, or property without the approval of a majority of its electors. (Harris-Fla)
W69-07325

TOWNSHIPS: WHARFS, PIERS AND DOCKS.

Mich Comp Laws Ann secs 41.481, 41.482 (1967).

Descriptors: *Michigan, *Operation and maintenance, *Piers, *Docks, Legislation, Contracts, Water law, Public rights, Leases, Navigable waters, Legal aspects, Cities, Administrative agencies, Public benefits, Construction.
Identifiers: *Townships, *Elector approval.

Any township situated upon any navigable waters may, through its township board, acquire, construct, and maintain wharfs, piers, docks and landing places for the public benefit. Authorization shall be by an affirmative vote of 3/5 of the qualified electors voting at a general or special election. The township board is vested with authority usually exercised by the township's highway commissioner, and the general highway law is extended to include such landing places. (Harris-Fla)
W69-07326

SEWERS AND DRAINS.

Me Rev Stat Ann tit 30, secs 4351--4359 (1965), as amended, (Supp 1968).

Descriptors: *Maine, *Legislation, *Sewers, *Drains, *Cities, Conduits, Drainage systems, Pipes, Sewage, Storm drains, Subsurface drains, Cesspools, Septic tanks, Drainage programs, Outlets, Condemnation, Local governments, Domestic wastes, Legal aspects.

Towns may construct public drains and sewers when such are deemed necessary for the public good. Public drains shall be maintained so as to provide suitable flow. If drains are not kept in repair, any person damaged by reason of such disrepair shall have an action against the town. Before land is taken for drains, notice shall be given and damages assessed and paid. The municipal officers may establish and collect service charges for the use of the system. Whoever wilfully or carelessly injures a public drain shall be liable for double

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damages. If a drain is to cross a railroad, unless a place for crossing can be determined by the town and railroad company, the public utilities commission shall choose an appropriate place. No one shall dig up a highway to lay a drain without consent of the town. Malfunctioning domestic sewage disposal units are to be considered a nuisance. An order to remedy a malfunctioning domestic unit may be sued upon by the landowner or occupant, and he shall have 10 days to remedy the defect. If the nuisance is not abated in 10 days, the municipal officers may enter upon the premises and remedy the malfunction. Any expenses of entry shall be recovered from the owner or by means of a tax assessed upon and collected in the next tax warrant. (Helwig-Fla)
W69-07327

JOHNSON V AGERBECK (SURFACE WATERS).
77 NW 2d 539-551 (Minn 1956).

Descriptors: *Minnesota, *Surface waters, *Reasonable use, Surface drainage, Surface runoff, Culverts, Ditches, Furrows, Drainage systems, Land use, Land forming, Agriculture, Judicial decisions, Legal aspects.
Identifiers: Injunctions.

The Minnesota Supreme Court reversed injunctive relief awarded by the lower court to plaintiff landowners in his action to compel defendants to fill up a ditch through which surface waters flowed onto plaintiffs' land. The court held that the evidence, particularly expert testimony on behalf of the defendants by engineers regarding land levels and height, did not support the lower court's finding that defendants had unreasonably caused surface waters to flow in increased volume onto plaintiffs' land. After defining surface waters, the court enunciated Minnesota's rule regarding reasonable use thereof: In making reasonable use of land for a legitimate purpose, a landowner may drain his land of surface waters and cast them upon adjacent land provided that he heeds existing circumstances, that there is a reasonable necessity for such drainage, that he takes reasonable care to avoid unnecessary injury to adjacent land, that utility or benefit accruing to his land reasonably outweighs harm resulting to burdened land, and that, where practicable, it is accomplished by reasonably improving the normal system of drainage according to its reasonable care and capacity. (Carruthers-Fla)
W69-07328

DELAWARE RIVER BASIN WATER COMM'N COMPACT.

N Y Unconsolidated Laws secs 1581, 1582, 1583, 1584 (McKinney Supp Dec 1968).

Descriptors: *New York, *Delaware River, *Interstate compacts, *Water resources development, New Jersey, Pennsylvania, Delaware River Basin Comm'n, Streams, Surface waters, State governments, Dams, Reservoirs, Impounded waters, Riparian rights, Riparian lands, Eminent domain, Condemnation, Legislation, Water conservation, Water demand, Water supply, Water distribution (Applied), Public benefits, Legal aspects, Competing uses.

The states of New Jersey, New York, and Pennsylvania, having a common interest in the waters of the Delaware River Basin, have entered into a compact. This compact is intended to facilitate the development, utilization, control and conservation of the water resources of the Delaware River. The states have agreed to create a joint advisory board known as the 'Delaware River Basin Water Commission'. The function of this commission is to formulate and recommend integrated programs for the development of the water resources of the Delaware River Basin. The Commission is to study the feasibility of the future construction of an integrated water supply system which would supply the water needs of all the signatory states. The Commission is responsible for providing an adequate minimum flow in the Delaware River and is required to provide an adequate supply of water for such purposes as navigation, flood control, and production of hydroelectric power. The Commission is empowered to effectuate the foregoing purposes through the acquisition of dams, reservoirs, and related facilities. The Delaware Basin constitutes all that land from which surface water drains naturally into the Delaware River. (Katz-Fla)
W69-07329

SEABOARD AIR LINE RR V SARASOTA-FRUITVILLE DRAINAGE DIST (LIABILITY OF DRAINAGE DIST FOR ITS TORTS).
255 F 2d 622-626 (5th Cir 1958).

Descriptors: *United States, *Drainage districts, *Railroads, *Contracts, Ditches, Culverts, Installation, Right of way, Drains, Administrative agencies, Taxes, Maintenance, Permits, Legal aspects, State governments, Florida.
Identifiers: *Public policy, Torts.

A railroad brought an action against a drainage district for damages from a train derailment allegedly caused by the lowering of ditches adjacent to the district's undertrack culverts causing the railroad's roadbed to give way. Plaintiff alleged that the defendant was liable under an agreement whereby defendant agreed to indemnify the railroad for damages growing out of the presence of culverts which plaintiff had permitted defendant to install beneath its tracks. The court stated that the sovereign cannot be sued without its consent. Furthermore, under Florida law, a statutory drainage district is not liable for its torts as the district can only levy taxes for the improvement and maintenance of the district. The court declared that since the district could not be liable by law in tort for its negligence, it should not be allowed to accept such liability as consideration for the acquisition of a valuable right. The court concluded that where a taxing unit such as defendant district obligates itself to use tax money in a way not authorized, this amounts to an illegal commitment to expend tax funds and is against public policy. Therefore, the indemnity agreement was void and plaintiff could not enforce it to recover damages. (Reed-Fla)
W69-07330

LOPEZ V SMITH (BOUNDARY DISPUTE).

109 So 2d 176-180 (Fla DCA 1959).

Descriptors: *Florida, *Boundary disputes, *Navigable rivers, Nonnavigable waters, Patents, Meanders, Tributaries, Tides, High water mark, Tidal waters, Water levels, Judicial decisions, Water law, Water rights, Streams, Legal aspects.
Identifiers: Suit to quiet title.

The Second District Court of Appeal of Florida reversed a chancellor's decree which dismissed appellants' complaint in an action to quiet title to certain islands bordering on a river and its branches. On appeal the court delineated the main issue between the respective parties as involving the location of the boundary lines of certain government lots. This issue, in turn, was dependent on two others: (1) whether the meander lines or the ordinary high water mark delineate the boundaries, and (2) whether all of the branches of the Little Manatee River are navigable. The court noted the general rule that a meander line is not a boundary and that generally the ordinary high water mark of lands located upon navigable waters delineates the boundary. The court also observed that the factor which determines navigability is the water's capacity for navigation, not its usage for that purpose and that navigable waters do not extend to all waters affected by tides which are not in fact capable of navigation for useful public purposes. Since the pleadings did not incontrovertibly establish navigability, the complaint was sufficient to withstand t motion to dismiss. (Carruthers-Fla)
W69-07331

TYSON V STATE OF IOWA (OWNERSHIP (ACCRETED LAND).

283 F 2d 802-811 (8th Cir 1960).

Descriptors: *Iowa, *Missouri River, *Nebrask *Accretion (Legal aspects), Federal governme Riparian land, Channel improvement, Condemn tion, Islands, State jurisdiction, River beds, Be under water, Boundary disputes, Owners of beds, Boundaries (Property), Riparian rights.

In an action by the United States to condemn la needed to stabilize the channel of the Misso River, there were conflicting claims as to own ship of the land. The court found Iowa law appli ble since the entire river bed was located in Io The court rejected the first defendant's claim sin under Iowa law, when a river moves over t owner's land, gradually destroying it, title to t shifting bed passes from the owner to the sta Islands subsequently forming on this bed likew belong to the state. The second claim established ownership of the lands in Nebraska the Nebraska bank of the river and claimed all land in controversy as accretions to his la Although both Iowa and Nebraska recognize right to acquire land by accretion, under Iowa l the riparian owner does not own the river bed the thread of the stream. The court found that land in controversy had formed as islands grow up from the river bed; thus, title was vested in state of Iowa. The state of Iowa was determined be the owner of all the land in controversy. (Kah Fla)
W69-07332

ILLINOIS CENTRAL RAILROAD CO GEORGE (DIVERSION OF SURFA WATERS).
130 So 2d 260-262 (Miss 1961).

Descriptors: *Mississippi, *Diversion structu *Railroads, Right of way, Relative rights, Flun Judicial decisions, Alteration of flow, Dama Conveyance structures, Ditches, Drains, Draina Surface waters, Surface drainage, Legal aspe Flooding.
Identifiers: Perpetual injunction.

The Supreme Court of Mississippi affirmed chancery court's award of damages but rever the perpetual injunction rendered against def dant railroad in plaintiff landowner's action damages and injunctive relief for defendant's di sion of waters onto plaintiff's land. The evide was found to support plaintiff's allegation that railroads widening of drainage ditches along right of way caused drainage of about three tir as much surface water upon plaintiff's land as theretofore drained upon plaintiff's land. T necessitated plaintiff's construction of an e flume to take care of the excess water. But court considered the perpetual injunction enjoi the railroad from permitting any surface wate flow from a certain point along its right of wa another point thereon to be too vague to enable railroad to determine from the face of the dec just what it is enjoined from doing or not do The court remanded the case in order to allow chancery court to grant more specific injunctive lief. (Carruthers-Fla)
W69-07333

CITY COUNCIL OF AUGUSTA V THORP (TERFERENCE WITH NATURAL DRAINAGE

103 Ga App 431, 119 SE 2d 595-598 (1961).

Descriptors: *Georgia, *Cities, Drainage syste Road design, Road construction, City planni Land development, Judicial decisions, Surfa

rs, Damages, Alteration of flow, Diversion, rsion structures, Flood damage, Flooding, l aspects.
ifiers: Continuing nuisance.

court affirmed a judgment for plaintiff ered by the lower court in an action against the of Augusta and subdivision developers for ling and other damage caused by improper truction of streets. The city had been a party to ntract with subdivision developers whereby the drew plans for street construction which were performed by the developers. The streets al-ly were constructed in so negligent a manner collect, divert and channel all the surface r onto and across plaintiff's property, causing damage. The court observed that a general of power to grade streets and establish age systems does not include the right of a cipality to create a nuisance by causing sur-water to be discharged upon a citizen's ises. The court further found that the nce supported the lower court's finding of gence and continuing nuisance. (Carruthers-

-07334

RRIS V STATE (FLOOD DAMAGE CAUSED TATE CONSTRUCTION PROJECT).

D 2d 754, 198 NYS 2d 59-62 (1960).

riptors: *New York, *Drainage engineering, od damage, *State governments, Culverts, ds, Contract administration, Cities, Spillways, d control, Drainage systems, Distribution ms, Municipal wastes, Surface drainage, Road truction, Legal aspects.
ifiers: *Nondelegable duties, Independent ractors, Respondent superior, Agency.

erty owners brought an action against the state flood damage allegedly resulting from the 's negligence in providing defective specifica-for a construction project and from the ner of actual construction. During a storm, damage was caused by the obstruction of a rt. Initially, the court rejected plaintiffs' claim the state was negligent because it was in con-of the work. The court stated that where such is being done by an independent contractor, resence of state engineers is not for the pur-of exercising control over the manner of con-tion, but to see that the plans are adhered to ne contractor. The court also found that the undertaken pursuant to the project was not of herently dangerous nature and that the state's to use care in performance of the project was nondelegable duty. The court further held the specifications for the project were not de-e, but designed according to proper engineer-rocedure. Since the independent contractor ot a party to the action, the court did not pass s liability. The state was without liability for ood damage. (Reed-Fla)
-07336

S AND PROGRAMS PERTAINING TO ER AND RELATED LAND RESOURCES,
s Water Development Board, Austin.
ld B. Yarbrough.
Water Develop Board Rep No 89, Dec 1968.

riptors: *Water law, *Texas, *Prior appropria-*Riparian rights, Treaties, Water policy, r resources development, Water rights, Water fer, Governments, Civil law, Interstate com-, Water allocation (Policy), Administration.
ifiers: *Texas Water Development Board.

history of Texas water law is reviewed. All , National, International and legal agencies erned with water are listed, and the roles of cts, local agencies, and interstate compacts in linating water activities in Texas are outlined. s recognizes 2 fundamental doctrines of water rights, the Riparian and Appropriation types. All streambeds, lakes, bays, and beds of navigable waters belong to the State. (Knapp-USGS)
W69-07408

VALUES, ETHICS AND POLICY IN RELATION TO RESOURCE DEVELOPMENT AND CONSERVATION: A SELECTED BIBLIOGRAPHY,
Nevada Univ., Reno. Dept. of Philosophy.
Robert Roelofs.
Desert Research Institute, Water Resources Research Center, Preliminary First Edition, 18 pp, Apr 1968. 194 ref.

Descriptors: *Values, *Ethics, *Resource development, *Conservation, *Bibliographies, History, Resources, Ecology, Economics, Education, Natural resources, Environment.
Identifiers: *Public policy, *Environmental problems, Future studies, Science and technology, Philosophy.

There is a growing concern over environmental deterioration and adverse biological and psychological effects it may have on individuals and, eventually, on our social institutions and society as a whole. This bibliography is a preliminary attempt to organize books and articles dealing with problems concerning natural resources and natural environment with emphasis on social and humanistic concerns relating to the environment. This preliminary first edition contains 194 entries which are numered, classified, and cross-indexed under eleven topics. The topics and relative percentages of entries relating to each, are as follows: History, 5 percent; Resources, 10 percent; Conservation, 8 percent; Ecology, 5 percent; Economics, 7 percent; Public Policy, 19 percent; Future Studies, 6 percent; Science and Technology, 6 percent; Human Values, 23 percent; Philosophy, 6 percent; Education, 5 percent. Items included in the bibliography are chosen on their relevance to one or more of these topics from the viewpoint of social and personal values, and realization potential in light of realities of the environment. The author's stated purpose in compiling the bibliography is to furnish a guide to specialists involved in resource investigations, and concerned with the broader implications of their task; as well as social scientists and others involved in various aspects of environmental problems. (Ketelle-Wisc)
W69-07437

MUNICIPAL WATER PROBLEMS - SOME LEGAL ASPECTS,
Thomas A. Matthews.
Current Municipal Problems, Vol 1, No 1, pp 8-16, August 1959. 8 p.

Descriptors: *Legal aspects, *Municipal water supply, Distribution, Water quality control, Financing, Irrigation, Jurisdiction, *Legislation, Institutional constraints, Public benefits, Public rights, Equitable apportionment, Supply contracts, Water transfer, Riparian rights.
Identifiers: Legislative aspects.

Where the source of water supply is distant from the area to be served, the legislature should grant authority to acquire and make use of a source of supply. Municipalities should also have the power to prevent contamination of the source. The legislature must resolve conflicts of interests between various municipalities and between agricultural and urban interests. There is a growing need for legislation to control and regulate the use of water from underground sources in order to insure proper distribution of the limited supply among those consumers needing it. Potential legal problems could arise from 'cloud seeding', weather modification, and controlled subterranean nuclear explosions to affect underground supply. Certain recommendations are made: (1) adequate means of financing, by revenue bonds or otherwise, must be made available, (2) statutes preventing pollution of water supplies, and (3) the legislature should allocate the right to use both underground and surface sources between municipal and agricultural uses, and between urban communities whose needs may conflict. (Gargola-Chicago)
W69-07452

THE ADMINISTRATION OF OFFSHORE MINERAL LEASING STATUTES IN THE GULF OF MEXICO (LOUISIANA AND TEXAS),
For primary bibliographic entry see Field 05G.
W69-07577

NATIONAL WATER COMM'N.

Hearings on S 3107 Before the Senate Comm on Interior and insular Affairs, 89th Cong, 2nd Sess (1966).

Descriptors: *United States, *Water resources development, *Planning, *Water requirements, Legislation, Water allocation (Policy), Social aspects, Water utilization, Natural resources, Conservation, Economics, Water supply, Pollution, Water policy, Inter-basin transfers, Desalination, Water purification, Water reuse, Institutions, Water resources planning, Future planning (Projected), Legal aspects.
Identifiers: *National Water Comm'n, Senate Hearings.

A hearing was held before the Senate Committee on Interior and Insular Affairs on S 3107. This bill would create a national water commission which would: (1) review present and anticipated national water resource problems, project water requirements and identify alternative ways to meet these requirements--considering conservation, more efficient use of existing supplies, increased usability by reduction of pollution, innovations to encourage the highest economic use of water, inter-basin transfers, and technological advances such as desalting, waste water purification and reuse; (2) consider economic and social consequences of water resource development, including the impact of water resource development on regional economic growth, on institutional arrangements and on aesthetic values; and (3) advise on such specific water resource matters as may be referred to it by the President and the Water Resources Council. (Childs-Fla)
W69-07580

THE ATLANTIC STATES MARINE FISHERIES COMM'N.

Conn Gen Stat Ann secs 26-295 to 26-301 (1960).

Descriptors: *Connecticut, *Fisheries, *Fish conservation, *Interstate compacts, Legal aspects, Legislation, Regulation, Fish management, Wildlife conservation, Commercial fishing, Financing, Administrative agencies, State governments.
Identifiers: Atlantic State Marine Fisheries Comm'n.

The governor of Connecticut is empowered to execute a compact on behalf of the state in the Atlantic States Fisheries Commission. The Commission is open to all states on the Atlantic seaboard. The statute further goes on to recognize the compact in Connecticut and establish qualifications and powers of members to the Commission established by the compact. Provision is made for funds for the Commission as well as for accounting for receipts and disbursements by that body. (Johnson-Fla)
W69-07581

COMPACT FOR STATE MEMBERSHIP IN THE ATLANTIC STATES MARINE FISHERIES COMM'N.

Conn Gen Stat Ann sec 26-295 (1960).

Descriptors: *Connecticut, *Fisheries, *Fish conservation, *Interstate compacts, Legal aspects, Legislation, Regulation, Federal government,

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Water management (Applied), Fish management, Habitat improvement, Marine fish, Anadromous fish, Water conservation, Fish, Wildlife conservation, Commercial fishing, Financing, Administrative agencies, State governments.
Identifiers: Federal-state relations, Atlantic State Marine Fisheries Comm'n.

The compact's purpose is promotion of better utilization of Atlantic seaboard fisheries by development of a joint program for the promotion, protection, and conservation of such fisheries. The agreement becomes effective when any two or more Atlantic seaboard states join. Each member state will appoint three representatives to the Commission. One each will be selected from the appropriate department of the state's executive and legislative branches and one from the interested public. The duty of the Commission is to promote and bring about conservation of and prevention of depletion and physical waste of the fisheries, marine, shell and anadromous, of the Atlantic seaboard. The Commission may recommend coordination of the police powers of the several states, as well as suggest pertinent legislation. It may consult with appropriate administrative agencies of signatories. The Commission is further permitted to recommend stocking of waters and will be the coordinating agency for joint stocking. In cooperation with state agencies the federal fish and Wildlife Service of the Department of the Interior will act as research agency for the Commission. Annual appropriations in proportion to market value of fisheries products are established. (Johnson-Fla)
W69-07582

THE ATLANTIC STATES MARINE FISHERIES COMM'N (IMPLEMENTATION).

Conn Gen Stat Ann secs 26-296 to 26-301 (1960).

Descriptors: *Connecticut, *Fisheries, *Fish management, *Interstate compacts, Fish conservation, Legal aspects, Legislation, State governments, Administrative agencies, Financing, Commercial fishing, Marine fish, Anadromous fish, Fish management, Fish, Water management (Applied), Interstate commissions.
Identifiers: Atlantic States Marine Fisheries Comm'n.

Adoption of the compact creating the Commission as a joint regulatory agency with such powers as members may jointly confer upon it for the regulation of fishing operations in which members have a common interest is made. Commissioners from Connecticut will be: (1) chairman of the state board of fisheries and game, (2) a legislator and member of the Commission on intergovernmental cooperation of the state, and (3) a citizen with a knowledge and interest in the marine fisheries problem appointed by the governor. Term of office of the first two will correspond with their holding of public office. The latter's term will be three years. Powers in the compact are granted to the Commission. All officers of the state are directed to cooperate in carrying out the purposes of the compact. The Commission on intergovernmental cooperation will include in its budget necessary funds required by the Commission. The Commission will keep appropriate accounts of receipts and expenditures. (Johnson-Fla)
W69-07583

CHARACTERIZATION OF INTERSTATE ARRANGEMENTS: WHEN IS A COMPACT NOT A COMPACT,
David E. Engdahl.
Mich L Rev, Vol 64, No 1, pp 63-104, Nov 1965. 42 p, 212 ref.

Descriptors: *Interstate compacts, *Interstate rivers, *International law, *State governments, Political aspects, Legal aspects, Boundary disputes, Public health, Conservation, Judicial decisions, Federal government, Safety.
Identifiers: *Constitutional law.

Formal interstate arrangements dealing with governmental problems affecting more than one state have become increasingly common in recent years. These 'compacts' generally deal with coordinated programs to promote conservation, health, safety, and similar matters such as interstate canals, bridges, and settlement of boundary water disputes. The question often arises whether such arrangements come within Article I, section 10 of The United States Constitution, which forbids entry by any state into a treaty, alliance, or confederation, and requires congressional consent for any agreement or compact with another state or foreign power. A study in semantics reveals that federal and state courts have erred in assuming all such agreements come within the constitutional provision. Although congressional assent may be sought to secure federal assistance or political gains, it is required by the Constitution only in case of 'dispositive' arrangements such as those apportioning interstate waters--not in the vast majority of 'cooperative' arrangements. The courts should review past decisions in light of the practical need for freedom among the states to cooperate so long as such cooperation does not preempt federal authority. (Harris-Fla)
W69-07584

PASSAIC VALLEY SEWERAGE DISTRICT.
For primary bibliographic entry see Field 05G.
W69-07585

JOHNSON V WILLS (DRAINAGE OVER ADJACENT PROPERTY).
For primary bibliographic entry see Field 04A.
W69-07586

HALL V WANTZ (PUBLIC EASEMENT OF NAVIGATION TO RIPARIAN RIGHTS).

336 Mich 112, 57 NS2d 462-465 (1953).

Descriptors: *Michigan, *Public rights, *Competing uses, Riparian rights, Lakes, Lake shores, Judicial decisions, Navigation, Navigable waters, Public benefits, Relative rights, Riparian land, Recreation, Reasonable use, Fishing, Water law, Easements, Great Lakes, Inland waterways.
Identifiers: *Subaqueous lands, White Lake, Anchorage, Injunctions (Permanent).

Plaintiffs appealed from a lower court ruling dismissing plaintiffs' bill of complaint for a perpetual injunction restraining defendant from mooring his fishing raft along the shore of plaintiffs' properties fronting on Michigan's White Lake. The Supreme Court of Michigan granted a permanent injunction restraining defendant from anchoring his 40 foot floating raft, from which defendant permits persons to fish for a fee, in front of plaintiffs' shoreline. The court reviewed Michigan's laws regarding the rights of the public and riparian owners to use of navigable inland waterways and concluded that while a riparian owner's property rights to subaqueous lands are subject to an easement in the public for general recreation and navigation purposes, nevertheless the right of navigation does not include the right to anchor indefinitely off the riparian owner's premises, particularly when it is attended with consequent impairment of the riparian owner's use and enjoyment of his property rights. (Carruthers-Fla)
W69-07587

ROUND VALLEY RESERVATION SPRUCE RUN RESERVATION.

N J Stat Ann secs 58:20-1 to 58:20-4, 58:21-1 to 58:21-5.

Descriptors: *New Jersey, *Reservoirs, *Water resource development, *Water supply, Legislation, Eminent domain, Conservation, Water resources, Water utilization, Planning, Water policy, Water management (Applied), Construction, Stream flow, Water works, Eminent domain, Flow rates, Administrative agencies, Delaware River, distribution (Applied).

The Commissioner of Conservation and Eco Development shall acquire for the state such of Round Valley as is appropriate for the esta ment of a water supply system. The Delaware or the south branch of the Raritan River sh the source. No water shall be pumped fro Raritan into a reservoir to be constructed wh flow is below certain specified rates, or from 15 to September 15 of any year. Whenever th is below the specified rates, water shall be rel from such other reservoirs as may be constr on the Raritan to make up the deficiency. completion of the reservoir not less than 83 gallons daily shall be released into Prescott and not less than 170,000 gallons daily int south branch of Rockaway Creek. Acquisiti property shall be by purchase or by em domain with the attorney general representin state. Real property shall be used primarily in nection with a water supply system, but m used incidentally for recreation or other state The commissioner is ordered to obtain part area called Spruce Run for the establishmen water supply system. Acquisition shall b purchase or eminent domain. The commiss may exchange lands acquired in excess of needs for other lands authorized to be acq Real property shall be used primarily for a supply system, but may be used incidental recreation or other state needs. (Kahle-Fla)
W69-07588

WEBB V GIDDENS (RIPARIAN RIGHTS).
82 So 2d 743-745 (Fla 1955).

Descriptors: *Florida, *Riparian rights, *Navi waters, *Road construction, Recreation, aspects, Judicial decisions, Riparian land, Ob tion to flow, Relative rights, Lakes, Bo Swimming, Fishing, Access routes, Hunting, fills, Culverts.
Identifiers: Right of ingress, Right of egress.

Plaintiff was a riparian owner of lands border an arm of a navigable, landlocked lake. Plai business was that of renting boats. The state department removed an existing bridge and b landfill across the arm of the lake. Plaintiff br suit to determine the right of defendants to ob navigable waters and prevent plaintiff from pa from his land to the larger body of the lake. D dants claimed that plaintiff's riparian rights guaranteed him ingress and egress to the wate mediately adjacent to his land, and that the of ingress and egress to the main body of the was not an infringement upon his riparian pro torship. The court held that the rights of rip proprietorship must be determined by the fact circumstances of each case. The court stated in the present case the plaintiff's right wou meaningless unless he were allowed access t main body of the lake. (Shevin-Fla)
W69-07589

ISELIN V C W HUNTER CO (OWNERSHI ACCRETION).

173 F 2d 388-393 (5th Cir 1949).

Descriptors: *Louisiana, *Accretion (aspects), *Land tenure, *Islands, Land for Judicial decisions, Legal aspects, Remedies, property, Riparian land, Avulsion, Rivers, Bou ries (Property), Adjudication procedure, law, Maps.

Appellants sought to establish their title to o land which they alleged was in their posse The land in question, also claimed by appellee part of an island in the Mississippi River bet Louisiana and Mississippi. Appellee acquired from the appellants and the land was desc within the deed generally by metes and bounds more particularly, by reference to a map

cted the general descriptions. Appellants ed that the land identified by the map was er in area than that indicated by the metes and ls description. Appellee's claim was based the broader general descriptions. Particularly ie was whether appellants had divested them- of the full acreage embraced in all three ptions. The court held that appellants had a of action and were entitled to a plenary trial e issues involving which descriptions were ninitive. The court indicated that where tions are entirely to an island, land so formed gs to the owner of the island. They also noted vhat constitutes avulsion is a question of law, whether avulsion occurred is a question of Holt-Fla)
07590

ELLANEOUS STATUTES (WATERSHED AGEMENT).
rimary bibliographic entry see Field 04D.
07591

W V JOHNSTON (TITLE TO LAND MED BY ACCRETION).
W 2d 193-197 (Ark 1946).

iptors: *Arkansas, *Accretion (Legal ts), *Land tenure, *Boundaries (Property), s, Taxes, Mississippi River, Legislation, River Withdrawal, Surveys, Charts, Locating, Ter- nalysis, Riparian land, Land forming, Judicial ons, Water levels, Remedies.
fiers: *Adverse possession, Laches.

iff brought suit to quiet title to an island in the ssippi River, alleging payment of taxes on said or fifteen years under color of title. Defen- asserted that the area described in the com- was formed from accretions to their island. argued that, because they had paid taxes on iginal land, they had necessarily paid taxes on ccretions and therefore, were entitled to be red owners of the accretions. The court ed out that title to land carries with it all tions formed thereto, whether or not men- l in the formal instrument of conveyance. The declared that in order for land to constitute and in a river, such land must be permanently unded by a river channel at all river water . The court was of the opinion that the nce established that the area in controversy sented accretions to defendants' island, and he testimony showed that plaintiff's land had washed away and never reappeared. Further- the court rejected plaintiff's claim of adverse ssion because the land described in the assess- books on which plaintiff paid taxes was the which had disappeared not the land formed by tion. (Reed-Fla)
07592

TIN V STANDARD OIL CO OF NEW JER- (ESTABLISHMENT OF RIPARIAN BOUN- ES).

2d 523-528 (D C Cir 1952).

iptors: *District of Columbia, *Riparian , *Boundaries (Property), Rivers, Piers, s, Bulkhead line, Navigable waters, Permits, s and Harbors Act, Federal government, ian waters, Legal aspects, Remedies, Judicial ons.
fiers: Wharfing rights, Injunctions (Prohibito-

controversy over the location of wharfing plaintiff requested an injunction requiring dants to remove a pier and piles, alleging that encroached on her riparian area. The dispute because the dry-land boundaries between the ctive riparian lots did not run at right angles to ver. Plaintiff claimed that the riparian boun- were projections of their lot lines. The dis- court found that the pier and piles did not en- croach upon plaintiff's riparian area and dismissed the complaint. It found that riparian boundaries were projections of lot lines to the bulkhead line and from there ran at right angles to the bulkhead line. Both parties appealed. The court affirmed dismissal of the complaint, holding that an encroachment could not be shown since the riparian boundaries had not yet been fixed. The court stated that these boundaries should be fixed so as to balance the conflicting interests of neighboring riparian owners and of the public, with due regard for existing structures. Since the setting off of such boundaries is work for special officials familiar with the demands of navigation and wharfing, the district court was unqualified to attempt to establish such boundaries. (Gabrielson-Fla)
W69-07593

WATER RESOURCES COMMISSION.
For primary bibliographic entry see Field 04A.
W69-07594

WATER RESOURCES COMMISSION.
For primary bibliographic entry see Field 04A.
W69-07595

WATER RESOURCES COMMISSION.
For primary bibliographic entry see Field 04A.
W69-07596

WATER RESOURCES COMMISSION.
For primary bibliographic entry see Field 04A.
W69-07597

WATER RESOURCES COMMISSION.
For primary bibliographic entry see Field 04A.
W69-07598

DISPOSAL OF SEWAGE.
For primary bibliographic entry see Field 05G.
W69-07599

WATER AND ICE SUPPLIES.
For primary bibliographic entry see Field 05G.
W69-07600

THAMES RIVER VALLEY FLOOD CONTROL COMM'N.
For primary bibliographic entry see Field 04A.
W69-07601

NORTHEASTERN WATER AND LAND RESOURCES COMPACT.
For primary bibliographic entry see Field 04A.
W69-07602

APPROPRIATION OF WATERS; RESERVOIRS AND DAMS.
For primary bibliographic entry see Field 04A.
W69-07603

WELLS.
For primary bibliographic entry see Field 04B.
W69-07604

WATER SKIING

Md Ann Code art 14B sec 11 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Water skiing, *Boats, *Boating regulations, Regulation, Legislation, Recreation, Safety, Water sports.

No person under 12 years of age may operate a motorboat for the purpose of towing another on water skis or similar device. Another person at least 12 years of age must be in the vessel to observe the skier. No towing is permitted between sunset and sunrise. This statute is inapplicable to professional exhibitions or authorized regattas. (Kahle-Fla)
W69-07605

CHIEF OF DIVISION OF WATER RESOURCES AND WATER RESOURCES BOARD.
For primary bibliographic entry see Field 05G.
W69-07606

POLLUTION ABATEMENT AND CONTROL.
For primary bibliographic entry see Field 05G.
W69-07607

STATE DEPARTMENT OF HEALTH.
For primary bibliographic entry see Field 05G.
W69-07608

SOIL CONSERVATION DISTRICTS TO PREVENT EROSION.
For primary bibliographic entry see Field 04D.
W69-07609

CRIMES (BOATING REGULATIONS).
Conn Gen Stat Ann secs 53-189 thru 53-194, 53-214 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *Boating regulations, *Pollution abatement, *Withdrawal, Water pollution, Contamination (Water), Water levels, Potable water, Public health, Water quality, Safety, Recreation, Boats, Legislation, Canoes, Lakes, Legal aspects.
Identifiers: *Penalties (Criminal), *Enforcement, *Motor boats.

Operation of a motor boat so as to endanger the life of persons not occupants of the boat shall be an offense punishable by fine and, or, imprisonment. Operation of a motor boat exceeding the specified engine sizes, or speeds, upon certain waterways within the state shall be punishable by fine. Operation of a boat or canoe on specified waters from one-half hour after sunset until one-half hour before sunrise without a white signal light shall be illegal and punishable by fine. Any person who causes water to be drawn off Bantam Lake by lowering the outlet shall be fined and, or, imprisoned. Pollution of any receptacle for drinking water by any foul substance shall be punished by fine and, or, imprisonment. (Harris-Fla)
W69-07610

MUNICIPAL PLANNING COMMISSION; SUBDIVISION OF LAND.

Conn Gen Stat Ann sec 8-25 (1958).

Descriptors: *Connecticut, *City planning, *Land development, *Administrative agencies, Land use, Drainage, Sewage systems, Water supply, Flood control, Flood forecasting, Water management (Applied), Recreation, Permits, Legislation, Roads, Public health, Public utilities, Legal aspects.
Identifiers: *Land subdivision, Penalties.

Subdivision of land must be approved by the Municipal Planning Commission. Any subdivision without approval shall be a finable offense. Subdivision plans must be filed, when approved, within 90 days or be null and void. Regulations for land subdivision shall be adopted by the commission after notice and hearing. Regulations shall provide for public health, water, drainage and sewerage. In areas adjacent to bodies of water subject to flooding, provision shall be made for flood control. Provisions must also be provided for public utilities, recreational needs and streets. (Harris-Fla)
W69-07612

SYSTEM OF COUNTY DRAINAGE.
For primary bibliographic entry see Field 04A.

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W69-07616

FLOATING SAWDUST INTO STREAMS.
For primary bibliographic entry see Field 05G.
W69-07617

CONDEMNATION BY COUNTIES FOR WATERSHEDS.
For primary bibliographic entry see Field 04D.
W69-07618

WATER CONSERVATION AND IRRIGATION AGENCIES.
For primary bibliographic entry see Field 03F.
W69-07620

UNITED STATES V TWIN CITY POWER CO (VALUE OF WATER-FLOW AS PART OF CONDEMNATION COSTS).
For primary bibliographic entry see Field 04A.
W69-07623

WATER CONTRACTS.

Mich Comp Laws Ann secs 41.871-41.878 (1967), as amended, (Supp 1968).

Descriptors: *Michigan, *Local governments, *Supply contracts, *Water supply, Domestic water, Financing, Taxes, Loans, Interest, Cities, Payment, Legislation, Facilities.
Identifiers: *Township boards, *Fire control, *Elector referendums.

Township boards of any townships of 5,000 or more population are authorized to contract with other municipalities for water for fire protection and domestic use. Township boards may borrow funds to install facilities required by such contracts. Persons, firms, and corporations are authorized to loan funds for these purposes. Township boards may pledge sales tax revenues to secure payment of borrowed funds. Townships may enact ordinances to effectuate the purpose of this act and such ordinances shall become effective thirty days from publication unless a petition for a referendum intervenes. (Harris-Fla)
W69-07626

HURON-CLINTON METROPOLITAN AUTHORITY.

Mich Comp Laws Ann secs 119.51, 119.52, 119.53, 119.57-119.61 (1967), as amended, (Supp 1968).

Descriptors: *Michigan, *Local governments, *Parks, *Financing, Recreation facilities, Taxes, Boating, Fishing, Swimming, Legislation, Conservation, Assessments, Administrative agencies, Condemnation, Operation and maintenance, Real property, Land tenure, Eminent domain.
Identifiers: *Counties, *Elector approval, Enabling legislation.

The counties of Wayne, Washtenaw, Livingston, Oakland, and Macomb may form the Huron-Clinton metropolitan authority. The authority may promote, construct, own, and operate within or without its limits recreational parks with facilities for bathing, boating and fishing and other recreation. The authority may fix and collect charges for the use of facilities and may sell or purchase land, rights, or obligations subject to the approval of the electorate. The authority shall be governed by a board of commissioners and may levy a tax based on property value assessment or issue self-liquidating bonds, and disburse the revenues obtained. The authority may acquire property by purchase, gift, devise or condemnation. A referendum shall be submitted to the electors of the counties for approval of the act to incorporate the authority. Any of the counties shall constitute the authority if they approve the act by vote. (Harris-Fla)
W69-07627

MUNICIPALITIES - PARTICULAR POWERS.

Mich Comp Laws Ann secs 124.251-124.294 (1967), as amended, (Supp 1968).

Descriptors: *Michigan, *Cities, *Water supply, *Sewage disposal, Contract, Financing, Condemnation, Sewers, Storm drains, Taxes, Engineering, Income, Interest, Cost analysis, Local governments, Legislation, Water distribution (Applied), Sanitary engineering.
Identifiers: *Trust indentures.

Any two or more municipalities may incorporate an authority to acquire and operate plants used or useful in obtaining, treating, and distributing water. Articles of incorporation shall set forth powers to fulfill the corporate purpose. The authority may acquire and transfer property within or without its corporate limits, including by condemnation. The authority may enter into contracts of up to 50 years duration in order to sell or purchase water and may supply water to corporate or private consumers. Municipalities may also incorporate authorities to acquire and operate storm and sanitary sewers and sewage treatment plants used or useful in collecting and disposing of sewage or industrial wastes. Incorporation shall be as provided in this act. Contracts for sewage service shall not exceed 40 years and charges by either authority may be classified or varied from time to time. No change of jurisdiction over any territory by any municipality shall impair the contract obligation for either water or sewage services. The programs and contracts outlined shall be financed according to this act. (Harris-Fla)
W69-07628

REMOVAL OF SAND AND GRAVEL.

Conn Gen Stat Ann secs 25-10 through 25-18 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *Sands, *Gravels, *Excavation, *Tidal waters, Legislation, State governments, Channel improvement, Damages, Adjudication procedure, Channels, Permits, Navigation, Administrative regulation.
Identifiers: Penalties.

The Water Resources Commission is authorized to regulate the removal of sand and gravel from lands under tidal and coastal waters. A permit must be obtained for such removals. Procedures for hearings on permit applications are set out. The Commission is empowered to designate and lay out channels across state lands under tidal waters for the improvement of navigation. Procedures for the taking of sand or gravel from such channels are provided. Bond must be posted by the person taking the material if it is likely that someone will be damaged by the removal. The superior court for Hartford County shall appoint a committee to determine the actual amount of damage which must be paid within 60 days of the judgment. Appeals from any commission order may be made to the superior court for Hartford County. Unauthorized removal of sand or gravel is punishable by a fine of $100 and/or imprisonment of not more than 30 days. (Kahle-Fla)
W69-07633

CITY OF COLUMBIA V LENTZ (OVERFLOW OF MUNICIPAL SEWAGE SYSTEM).
For primary bibliographic entry see Field 05C.
W69-07635

COMMON JURISDICTION OF COUNTIES.

Mich Comp Laws Ann secs 45.10, 45.12, 45.14 (1967), as amended, (Supp 1968).

Descriptors: *Michigan, *Great Lakes, *Jurisdiction, *Lake shores, Lake Michigan, Lake Huron, Lake Superior, Boundaries (Surfaces), Local governments, Legislation, Legal aspects.
Identifiers: *Counties, *Concurrent jurisdiction, *Enforcement, *State boundaries, Offenses (Criminal), Penalties (Criminal).

Counties now in existence or to be later or
which border upon the shores of Lake Mich
Lake Huron shall have jurisdiction of all c
committed on that part of the lake which i
the state. Offenses shall be tried in either of
counties nearest the site of the offense. Ch
county and later organized counties which
upon the shore of Lake Superior shall hav
mon jurisdiction over offenses on parts of t
within the state. Trial shall be had in the firs
ty to issue process against the offender. (
Fla)
W69-07636

FENCES-FENCE VIEWERS.

Mich Comp Laws Ann secs 43.9, 43.10 (19
amended, (Supp 1968).

Descriptors: *Michigan, *Boundaries (Pro
*Boundary disputes, *Land tenure, Ponds,
Ownership of beds, Legislation, Real pr
Natural streams, Barriers, Adjudication pro
Identifiers: *Fences, *Fence viewers, *
rights, *Arbitration.

When adjacent tracts of land require fenci
such tracts are bounded or separated by an
brook, pond or creek, a fence viewer must
whether the water itself is a sufficient fenc
determines that the watercourse is an insu
fence, that it is impractical to construct a fe
the true boundary, and that the owners
agree on whose side a fence will be contruc
fence viewers, on application made by a
notice given to the parties involved, shall de
the method of fencing and reduce such det
tion to writing. If either party fails to ma
fence as directed, the other party may do s
defaulting party's expense. (Harris-Fla)
W69-07637

OBSTRUCTION OF WATERS BY NEW CITY, NAVIGATION OF AMBROSE CH AND THE INTERFERENCE WITH NA TION IN NEW YORK HARBOR CHANN

33 USCA secs 452, 453, 454 (1957).

Descriptors: *New York, *Navigation, *
government, *Legislation, Shellfish, Ships
nels, Federal jurisdiction, Navigable
Federal-state water rights conflicts,
resources development, Navigable rivers,
Dredging, Harbors, Ships, Cities, Rivers.
Identifiers: Ambrose Channel, Corps of Eng

It is unlawful for any person or persons to e
fishing or dredging for shellfish in any of th
nels leading to and from the harbor of Ne
or to interfere in any way with the safe na
of those channels by ocean steamships and
deep draft. The Secretary of the Army is aut
to make such rules and regulations for the
tion of Ambrose Channel as he may deem
ry to insure its safe use in all kinds of weath
city of New York may obstruct navigation
river or other waterway which does not for
necting link between other navigable water
United States, and which lies wholly wit
limits of the city. Such obstruction shall be
ful unless the location and plans for the p
work shall have been filed with and appr
the Secretary of the Army and Chief of En
The city of New York shall be liable
damage that may be inflicted upon private p
by reason of any of the provisions of this
(Smith-Fla)
W69-07639

RIVER AND HARBOR IMPROVEMENTS

33 USCA secs 546a, 547, 549, 550 (19
amended, (Supp 1969).

Descriptors: *Shore protection, *H
*Legislation, Bank erosion, Deterioration,

Floods, Tides, Channels, Tidal effects, on (Legal aspects), Navigable waters, al jurisdiction, Shorelines, Local govern- Water resources development.
rs: *Water terminals, Corps of Engineers, e configuration, Interstate commerce.

eport submitted to Congress preliminary to ment of any river mouth or inlet shall con- rmation concerning the shoreline configu- en miles either side of the proposed im- ent. The report shall state the probable ef- the improvement on the shoreline by ero- d/or accretion. A report of the benefit ac- o the locality of the improvement shall be ed to Congress with recommendations for operation. Deterioration of previously ex- nprovements shall be reported, estimating t of repairing, or removing obstructions e improvements. The Chief of Engineers, U , shall report on the character of all water ls and transfers in harbors and waterways Inited States maintenance or improvement, ermine whether they are adequate for exist- merce. He shall submit reports describing minals, whether public or privately owned; and how they connect with railroad facili- d whether additional terminals are needed. al report shall state terminal types suitable onal use and adaptable to commercial con- tides, floods and other physical charac- . (Harris-Fla)
'640

IT OF REFUSE IN NAVIGABLE RS.
nary bibliographic entry see Field 05G.
'646

CTION OF NAVIGABLE WATERS - LATION OF TRANSPORTATION AND NG REFUSE IN NAVIGABLE WATERS - AND CRIBS ON MISSISSIPPI AND ST RIVERS.
nary bibliographic entry see Field 05G.
'647

CTION OF NAVIGABLE WATERS - IT OF REFUSE IN LAKE MICHIGAN CHICAGO.
nary bibliographic entry see Field 05G.
'648

LTZ V WINTHER (BOUNDARY DISPUTE R U S PATENT).

2d 1, 101 NW 2d 631-640 (1960).

tors: *Wisconsin, *Boundary disputes, *M- , *Patents, Shores, Lakes, Boundaries (Pro- Judicial determination, Administrative s, Federal government, Surveys, Judicial ns, Legal aspects.
ers: *Omitted lands, Constructive fraud.

fs claimed land under a 1956 U S patent defendants claimed under an 1872 patent. ue was whether an 1863 meander line or a re was to be treated as the boundary line of 72 patent. In 1953 the federal government a resurvey determining that the 1863 er line was so far from the lake shore as to omitted land between the original meander d the shore. Plaintiffs were granted the land in the 1956 patent. This court fol- the general rule that meander lines are not boundaries, but merely to define the sinuosi- the bank. The body of water and not the er line is the boundary. The court noted an on to the rule where the meander line is far away to be intended as a boundary line or the meander line is sufficiently in error to to a 'constructive fraud' on the govern- Here the record did not show the percentage ch the meander line understated the various lots except in the case of one lot by an area of 27%. Such error was held not sufficient to constitute constructive fraud. The government's decisions to resurvey was held to have no bearing on the case since 'constructive fraud' is a judicial determination. Judgment for defendants. (Kahle-Fla)
W69-07649

PEART V STATE (PAYMENT FOR LAND APPROPRIATED FOR HIGHWAY).

125 So 2d 673-682 (Ct App La 1961).

Descriptors: *Louisiana, *Highway relocation, *Riparian land, *Compensation, Levees, Highways, Judicial decisions, Public benefits, Navigable rivers, Legislation, Riparian rights, Damages, Condemnation, Right-of-way, Eminent domain, Easements, Condemnation value, Legal aspects.
Identifiers: Servitude.

Plaintiff brought suit to obtain payment for land appropriated to relocate a highway more than 200 feet from a new levee on the Red River. Plaintiff's land was located between the levee and the highway. The Department of Highways claimed no compensation was due. A civil code statute imposed servitudes upon lands of riparian owners on navigable rivers for the making and repairing of levees, roads and other public works. The court held that the statute had been interpreted to impose a servitude only when the public purpose was incident to the nature, navigable character, or use of the stream. Here the original highway and the relocated highway were intended only as thoroughfares for traffic between two cities. Likewise, a second statute providing that an owner bound to give a public road must furnish a second without compensation where the first is destroyed or impassable was inapplicable, since plaintiff was not bound to give the original road unless used incident to the navigable character of the stream. Plaintiffs were awarded compensation for the right-of-way and severance damages. (Kahle-Fla)
W69-07650

UNITED STATES V STATES OF LOUISIANA, TEXAS, MISSISSIPPI, ALABAMA AND FLORIDA (OWNERSHIP OF LANDS UNDERLYING GULF OF MEXICO).

364 U S 502, 81 S Ct 258-259 (1960).

Descriptors: *United States, *Gulf of Mexico, *Boundary disputes, *Ownership of beds, Louisiana, Texas, Mississippi, Alabama, Florida, Beds, Beds under water, Mineralogy, Boundaries (Surfaces), Coasts, Continental shelf, Judicial decisions, Legal aspects.
Identifiers: Coast line.

By the terms of a final decree in an action by the United States against Louisiana, Texas, Mississippi, Alabama, and Florida for a declaration of ownership of land, minerals and other natural resources underlying the Gulf of Mexico, the United States was entitled to land and minerals underlying the Gulf of Mexico more than three miles seaward from the coast lines of Louisiana, Mississippi and Alabama, and more than three leagues seaward from the coast lines of Texas and Florida, and extending to the edge of the continental shelf. None of the states or their assigns were entitled to any interest or use of said lands and minerals. As against the United States, the defendant states were entitled to land and minerals from their coast lines to the point where United States ownership vests as outlined above. The court defined 'coast line' as the line of ordinary low water along that portion of coast which is in direct contact with the sea and the line marking the seaward limit of inland waters. Defendant states were to promptly render to the United States all sums of money derived by such state since June 5, 1950, either by sale, leasing, licensing, exploitation or otherwise on account of any of the lands or resources lying beyond their limits of ownership. (Kahle-Fla)
W69-07651

PROTECTION OF NAVIGABLE WATERS - OBSTRUCTION OF NAVIGABLE WATERS AND THE ESTABLISHMENT OF HARBOR LINES.

33 USCA sec 403, 404, 405 (1957).

Descriptors: *Piers, *Federal government, *Legislation, *Navigable waters, Breakwaters, Bulkheads, Jetties, Harbors, Canals, Navigation, Excavation, Alteration of flow, Federal jurisdiction, Federal-state water rights conflicts, Water resources development, Navigable rivers.
Identifiers: Corps of Engineers, Secretary of the Army, Harbor lines.

Where he deems it necessary the Secretary of the Army is authorized to establish harbor lines, beyond which no piers, wharves, bulkheads, or other works may be extended or deposits made except under such regulations as he may prescribe. Unless authorized by Congress, the creation of any obstruction to the navigable capacity of any of the waters of the United States is prohibited. It is unlawful to build any wharf, breakwater, or other structure in any port, canal, navigable river, or other body of water outside established harbor lines, or where no harbor lines have been established, except on plans recommended by the Chief of Engineers and authorized by the Secretary of the Army. It is also unlawful to excavate or fill, or in any manner modify the course, condition or capacity of any port, roadstead, haven, harbor, canal, lake, harbor of refuge, or inclosure within the limits of any breakwater, or of the channel of any navigable water of the United States, unless the work has been authorized by the above officials. The above provisions are made specifically applicable to the Potomac and Anacostia Rivers. (Smith-Fla)
W69-07652

INJURY TO HARBOR OR RIVER IMPROVEMENTS.

33 USCA secs 408, 409 (1957).

Descriptors: *Legislation, *United States, *Federal government, *Navigable waters, Harbors, Bays, Obstruction to flow, Bridges, Dams, Streams, Permits, Regulation, Transportation, Coastal structures, Seawalls, Check structures, Jetties, Retaining walls, Navigable rivers, Channels, Docks, Piers, Engineering structures, Legal aspects.

It is unlawful for any person to use or take possession of any coastal structure erected by the United States to improve or preserve navigable waters or to prevent floods. It is unlawful to obstruct navigable channels by improper anchorage or by voluntarily sinking or causing to sink a craft within such a channel. It is unlawful, except as otherwise provided, to float loose timber and logs in a navigable channel or to float sack rafts therein. The owner of a craft sunken in a navigable channel must immediately mark such craft with a buoy and light. Such owner shall immediately take action to remove the craft. Failure to act will be taken to indicate that the vessel has been abandoned and the United States will then remove the craft. (Katz-Fla)
W69-07653

PROTECTION OF NAVIGABLE WATERS - SUMMARY REMOVAL OF WATER CRAFT OBSTRUCTING NAVIGATION.
33 USCA sec 415 (1957).

Descriptors: *Navigation, *Federal government, *Legislation, *Navigable waters, Bays, Canals, Locks, Rivers, Lakes, Federal jurisdiction, Federal-state water rights conflicts, Water resources development, Navigable rivers, Boats, Eminent domain.
Identifiers: Sunken watercraft, Obstruction to navigation, Secretary of the Army.

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In an emergency, any vessel, raft, or similar obstruction which is sinking or grounding, or being unnecessarily delayed in any Government canal or lock, or in any navigable waters, in such a manner as to stop, seriously interfere with, or endanger navigation, in the opinion of the Secretary of the Army or any agent to whom he may delegate proper authority, the Secretary or such agent shall have the right to take immediate possession of such boat or raft and remove or destroy it so as to clear the waters of the obstruction. The agent charged with the removal or destruction of an obstruction may in his discretion give notice in writing to the owners of any such obstruction requiring them to remove it. The expense of removing the obstruction shall be a charge against such craft and cargo, and if the owners fail or refuse to reimburse the United States for such expense within thirty days after notification, the agent may sell the craft or cargo, or any part thereof that may not have been destroyed, and the proceeds of such sale shall become the property of the United States government. (Smith-Fla)
W69-07654

OIL POLLUTION OF COASTAL WATERS - PROHIBITION AGAINST DISCHARGE OF OIL IN UNITED STATES WATERS.
For primary bibliographic entry see Field 05G.
W69-07656

THE DEPOSIT OF REFUSE IN N Y HARBOR AND ADJACENT WATERS IS PROHIBITED.
For primary bibliographic entry see Field 05G.
W69-07657

WATER POLLUTION CONTROL - CONGRESSIONAL DECLARATION OF POLICY.
For primary bibliographic entry see Field 05G.
W69-07658

WATER POLLUTION CONTROL - GRANTS FOR WATER POLLUTION CONTROL PROGRAMS - WATER POLLUTION CONTROL ADVISORY BOARD.
For primary bibliographic entry see Field 05G.
W69-07659

NAVIGATION AND NAVIGABLE WATERS.
For primary bibliographic entry see Field 05G.
W69-07660

RIVER AND HARBOR IMPROVEMENTS.
For primary bibliographic entry see Field 04A.
W69-07661

RIVER AND HARBOR IMPROVEMENTS - RIGHTS OF WAY, PRIVATE IMPROVEMENT, INTERSTATE COMPACTS AND THE POTOMAC DRAINAGE BASIN.
For primary bibliographic entry see Field 04A.
W69-07662

ACQUISITION OF LAND AND MATERIALS, REGULATION OF RESERVOIRS ON MISSISSIPPI.
For primary bibliographic entry see Field 04A.
W69-07663

COWAN V BAKER (LANDFILLS).
For primary bibliographic entry see Field 04A.
W69-07664

DITCHES, MARSHES, MEADOWS AND SWAMPS.
For primary bibliographic entry see Field 04A.
W69-07666

AUTHORITY AND DUTIES OF COMM'RS PERTAINING TO DITCHES, MARSHES, MEADOWS AND SWAMPS.
For primary bibliographic entry see Field 04A.
W69-07667

RIGHTS OF WETLAND PROPRIETORS.
For primary bibliographic entry see Field 04A.
W69-07668

APPEALS FROM ACTION OF THE COMMISSIONERS CONCERNING DRAINAGE OF WETLANDS.
For primary bibliographic entry see Field 04A.
W69-07669

JURISDICTION OF FENCE-VIEWERS.
For primary bibliographic entry see Field 04A.
W69-07670

COMPREHENSIVE HARBOR IMPROVEMENT ACT.
For primary bibliographic entry see Field 04A.
W69-07671

COMPREHENSIVE HARBOR IMPROVEMENT ACT.
For primary bibliographic entry see Field 04A.
W69-07672

COMPREHENSIVE HARBOR IMPROVEMENT ACT.
For primary bibliographic entry see Field 04A.
W69-07673

DAUGHERTY V CITY OF LEXINGTON (REASONABLE USE OF LAND).
For primary bibliographic entry see Field 05G.
W69-07674

ANDERSON V STATE (NON-RESIDENTS NOT ENTITLED TO COMMERCIAL FISHING LICENSE).

213 SW 2d 615-617 (Ark 1948).

Descriptors: *Arkansas, *Commercial fishing, *State jurisdiction, Beds, Fishing, Fish management, Judicial decisions, Legislation, Water resources, Water users, Wildlife management, Permits, Regulation, Ownership of beds.
Identifiers: Constitutional rights.

Defendants, non-residents of Arkansas, were arrested for illegally engaging in commercial fishing contrary to state law which prohibited the issuance of a commercial fishing license to any person who had not resided in the state at least 6 months. Defendants had obtained non-resident fishing licenses. The court held that the statute did not violate due process or discriminate against non-residents, since the state owns the beds of all waters within its jurisdiction and may appropriate their use to its citizens for the taking of fish. Such a right is a property right and not a mere privilege or immunity of citizenship that must be extended to non-residents nor is it a regulation of commerce. (Kahle-Fla)
W69-07675

SOIL CONSERVATION.
For primary bibliographic entry see Field 04D.
W69-07676

SCHATZ V GUTHRIE (RIGHT TO NAVIGATE A TRIBUTARY).
For primary bibliographic entry see Field 04A.
W69-07677

DOIRON V O'BRYAN (MEANING OF R AN RIGHTS IN A CONVEYANCE).
For primary bibliographic entry see Field 04
W69-07678

WATERS AND WATER SUPPLY.
For primary bibliographic entry see Field 03
W69-07679

NEW JERSEY WATER RESEARCH DEVELOPMENT COMM'N.

N J Stat Ann secs 58:23-1, 58:23-4, (1966).

Descriptors: *New Jersey, *Water *Planning, *Water resources development, management (Applied), Legislation, government, State governments, Conse Research and development, Water res Water utilization, Administrative agencies, supply, Water storage, Investigations, sources.

The New Jersey Water Research and Devel Commission is created. It consists of 9 mem appointed from the Senate by the p thereof, 3 from the General Assembly speaker, and 3 by the governor from the ci The terms of office shall be 3 years, provide ever, that a member of the legislature ma only so long as he remains in the legislatu commission shall keep informed of the pro the Water Policy and Supply Council with to water supply sources, development and of resources, and long-term planning. The c sion may exchange information with an agency, or the federal government in regard servation and development of water resources. The commission may employ assistants, incur traveling expenses, obtain expert advisors, hold hearings and make in tions. The commission shall report annuall governor and legislature setting forth resul vestigations and recommendations. The Wa visory Committee consists of 15 members f state at large appointed by resolution of th mission representing the northern, centr southern areas of the state. Terms of office 3 years. The committee shall meet at the ca commission to assist and advise the commi its duties. (Kahle-Fla)
W69-07680

USE AND DISPOSITION OF WATER.
For primary bibliographic entry see Field 04
W69-07681

AN ACT FOR THE ESTABLISHMENT INTERIM COMM'N ON THE UPPER M SIPPI RESERVOIRS.
For primary bibliographic entry see Field 04
W69-07682

SUSQUEHANNA RIVER BASIN CO ARTS 6, 7 and 8 (FLOOD PROTE WATERSHED MANAGEMENT AND RE TION).
For primary bibliographic entry see Field 04
W69-07683

SUSQUEHANNA RIVER BASIN CO ARTS 9, 10, 11 and 12 (PUBLIC V HYDROELECTRIC POWER, DIVERSION INTERGOVERNMENTAL RELATIONS).
For primary bibliographic entry see Field 04
W69-07684

SUSQUEHANNA RIVER BASIN COMM 14 (PLAN, PROGRAM AND BUDGETS).
For primary bibliographic entry see Field 04
W69-07685

TRACTS FOR INTERSTATE BRIDGES; ORT TO GOVERNOR; DIVERSION OF NAVIGABLE STREAM.
rimary bibliographic entry see Field 04A.
07686

RIES.
Code Ann secs 17-18-2 through 17-18-8, 17-, 17-18-16 through 17-18-18 (1966).

riptors: *West Virginia, *Navigable waters, nits, *Boats, Transportation, Boundaries perty), Legislation, Watercourses, Navigation, fer, Local governments, Riparian rights, lation, Navigable rivers, Riparian waters, Adtrative agencies, Maintenance costs, Initial Interstate rivers, Legal aspects.
ifiers: *Ferries, Shenandoah River, County s.

rson desiring to establish a ferry may present plication to the county court. If the watere represents a county boundary line, he may initially to either county court. The court then appoint at least two viewers to render an ory report on the advantages of the ferry. The may then reject or grant the application. If than one county is involved and the first court s to grant the application, it shall then certify port to the second county court which must e whether to grant or reject. Any person who ains an unauthorized ferry and any riparian r who permits the unauthorized ferry to be ained on his land shall be guilty of a meanor. A ferry must provide any person or rty with passage in a reasonable time. The y court of any county through which the Shenah River runs may establish and maintain not than three ferries across the river. The expenall be paid out of the county treasury. No in an adjacent state shall ferry to the shores of tate without the consent of the proprietor of rry established in this state which is operating two miles of such ferry. (Stewart-Fla)
07687

ERSHED IMPROVEMENT DISTRICTS.
rimary bibliographic entry see Field 04D.
07688

STEES OF INTERNAL IMPROVEMENT) V WETSTONE (ESTABLISHMENT OF NDARY LINE).

o 2d 10-19 (Fla 1969).

iptors: *Florida, *Boundary disputes, *Boun- (Property), High water mark, Islands, ts, Federal government, State governments, able waters, Mangrove swamps, Tides, Tidal s, Tidal effects, Water levels, Ownership of Shores, Land classification, Judicial deci- Legal aspects, Riparian land, Water law, ders.
fiers: Meander lines, High tide line.

iff sought a declaratory decree establishing a lary line between privately owned riparian ds and submerged sovereignty lands under able waters. Plaintiff landowner contended eander line established in 1875 represented oper boundary. The defendant trustees con- that the true mean high tide line controlled. ircuit court rendered judgment for the plainid the district court affirmed. On appeal on ct certiorari the Florida Supreme Court af- and held that where the true mean high tide circumscribing plaintiff's insular property not be located due to the fact that its outer were covered with mangrove swamp areas, e meander line established by the original nment survey could be located, and where ge conveyed by defendants to plaintiff's cessor in title was based on acreage referred the original government survey, the meander onstituted the boundary line between the plands and sovereignty lands. (Carruthers-

W69-07689

GAME AND FRESHWATER FISH.
For primary bibliographic entry see Field 08I.
W69-07690

INTERSTATE COMM'N ON THE POTOMAC RIVER BASIN.
For primary bibliographic entry see Field 05G.
W69-07691

ABATEMENT OF NUISANCES.
For primary bibliographic entry see Field 05G.
W69-07692

ACCRETION AND IMPROVEMENTS TO LAND ON NAVIGABLE WATER.
For primary bibliographic entry see Field 04A.
W69-07693

LEASING OF OYSTER BEDS.
For primary bibliographic entry see Field 03E.
W69-07694

HEALTH AND SAFETY.
For primary bibliographic entry see Field 05G.
W69-07695

CESSPOOLS, PRIVY WELLS AND DRAINAGE SYSTEMS.
For primary bibliographic entry see Field 05G.
W69-07696

POLLUTION OF STREAMS.
For primary bibliographic entry see Field 05G.
W69-07697

FISH.
For primary bibliographic entry see Field 03E.
W69-07698

PRIVATE PRESERVES.
For primary bibliographic entry see Field 03E.
W69-07699

6G. Ecologic Impact of Water Development

POND ECOLOGY AND WATERFOWL PRODUCTION IN RELATION TO OPTIMUM WATER RESOURCES UTILIZATION IN THE TURTLE MOUNTAINS OF NORTH DAKOTA,
North Dakota State Univ., Fargo. Dept. of Zoology.
J. Frank Cassel, and Robert E. Stewart, Jr.
Research Project Technical Completion Report to Office of Water Resources Research, Department of the Interior, April 1969. 50 p, 14 fig, 11 tab, 20 ref.

Descriptors: *Animal populations, *Ducks (Wild), *Ecology, *Water chemistry, *Wetlands, American Widgeon, Blue-Winged Teal, Broods Bufflehead Duck, Canvasback Duck, Common Goldeneyed Duck, Gadwall Duck, Green-Winged Teal, Lesser Scaup Duch, Mallard Duck, migratory birds, Pintail Ducks, Puddle Ducks, Redhead Duck, Ring-Neck Duck, Ruddy Duck, Shoveler Duck.

During drought years of 1967 and 1968, 60 quarter sections, including 206 wetlands, were studied in the Turtle Mountains of North Dakota. Waterfowl surveys were made, and wetlands were classified and sampled for water chemistry. Due to drought conditions, acreages of wetlands decreased progressively. Some wetlands were more abundant during the two years; cover types varied. Water chemistry determinations indicated a graphical relationship between wetland subclasses and specific conductance. Fifteen species of waterfowl were found in the area the most common of which were mallard, blue-winged teal, ring-necked duck, lesser scaup, redhead, and canvasback. Total waterfowl population estimates varied from 3768 plus or minus 1937 in 1967 to 3179 plus or minus 966 in 1968. Significant conclusions concerning dabbling ducks and diving ducks include: A decrease in spring densities was noted for most species from 1967 to 1968. Most species, except blue-winged teal, produced fewer broods in 1968 than in 1967. Average brood size for the most common species decreased in 1968. Dabbling ducks gathered in small mobile flocks during June, 1968. Diving ducks formed large mobile flocks during early and late June, 1968. Most ducks gave no indication of breeding activity other than maintenance of some pair bonds. Hatch peaks tended to be later in 1968. A large influx of dabbling ducks into the Turtle Mountains was recorded in June of 1968.
W69-07475

THE ORGANIZATION AND ANALYTICAL PROCEDURES REQUIRED BY A LARGE ECOLOGICAL SYSTEMS STUDY,
California Univ., Berkeley. Dept. of Entomology and Parasitology.
Ronald W. Stark.
Systems Analysis in Ecology, K E F Watt (ed), Academic Press, New York, pp 37-68, 1966. 7 fig, 3 tab, 49 ref.

Descriptors: *Ecosystems, *Systems analysis, *Analytical techniques, *Planning, Insect control, Pine trees, Sampling, Aerial photography, Computers, Research and development.
Identifiers: *Computer analysis, Beetles, Dendroctonus brevicomis.

A description is given of the organization and analytical procedures developed in studying the ecology of western pine beetles, Dendroctonus brevicomis. The objective was to learn how to predict the course of population buildups in order to control their destruction of ponderosa pine forests. 26 scientists from 10 academic, government, and industry departments were involved. A study of the geographic distribution of the beetle and its hosts was made, including seasonal variations. Up to the time of this report work has dealt with the elaboration of sampling procedures for the study of complex systems, in this case involving geography, season, infested trees, and insects within the trees, all with computer analysis capability in mind. Aerial photography for the analysis of populations of infested trees and X-ray techniques for analysis of insects within trees are found to be more efficient and economical than visual observation and bark dissection procedures. (Watts-Wisconsin)
W69-07576

07. RESOURCES DATA

7A. Network Design

HYDROLOGICAL FORECASTING IN THE USSR,
Hydrometeorological Service of the USSR (Moscow). Scientific Research Center.
For primary bibliographic entry see Field 02B.
W69-07379

RAINGAGE NETWORKS IN THE LARGEST CITIES,
American Society of Civil Engineers, Cambridge, Mass. Engineering Sciences Lab.
For primary bibliographic entry see Field 02B.
W69-07485

COMPUTER SOLUTIONS TO DISTRIBUTION NETWORK PROBLEMS,
Boeing Co., Renton, Wash.
Samuel L. W. Jacoby, and David W. Twigg.

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Proc, Nat Symp Anal Water-Resource Syst, pp 167-190, Denver, July 1-3, 1968. 28 p, 3 fig, 11 ref.

Descriptors: *Network design, *Simulation analysis, *Optimization, *Digital computers, Distribution systems, Mathematical models, Cost analysis, Water supply, Analytical techniques, Data processing.
Identifiers: Method of feasible directions, Gradient method.

Systematic methods of solving distribution network design problems using simulation and optimization techniques were presented. Non-linear models were constructed. Simulation, gradient, and 'methods of feasible directions' techniques were used. Data processing systems were used for the evaluation of network designs and for aiding parametric studies by improving the speed, accuracy and data handling characteristics of simulation problems optimizing network designs. The design of computing systems and the synthesis of the problems were discussed and plans for introducing optimization into simulation in the future were discussed. For main entry see W69-07562. (Thiuri-Cornell)
W69-07572

7B. Data Acquisition

POSSIBILITIES FOR REMOTE DETECTION OF WATER IN ARID AND SUBARID LANDS DERIVED FROM SATELLITE MEASUREMENTS IN THE ATMOSPHERIC WINDOW 3.5-4.2 mu,
National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.
Jean Pouquet.
International Conference on Arid Lands in a Changing World, Arizona University, Tucson, June 3-13, 1969. 17 p, 9 fig, 11 ref.

Descriptors: *Remote sensing, *Arid lands, *Subsurface waters, Soil water, Soil moisture, Soil temperature, Groundwater, Exploration, Hydrography, Mapping, Water resources development, Water supply, Aerial photography, Satellite (Artificial), Infrared radiation.

The purpose of this work was to survey water resources and assess agricultural possibilities in arid and subarid lands. Detection was either of subsurface water through its direct thermal effect or the soil moisture storage capacity. Daytime infrared radiations were almost useless because the scanned areas were too large; the eastern temperatures were too high, the western too low. But, nighttime infrared values proved most useful. (Soil moisture moves toward the cooler profile, at night the cool surface. It carries stored daytime warmth with it to the surface). Most useful were grid print maps of ground equivalent black body temperatures derived from Nimbus radiometer measurements in the 3.5-4.2 mu range. Several examples from Africa and North America are presented. By locating areas appearing warmer than they should be, preselection of promising areas for field exploration was made, which from the ground could take years. It is speculated that infrared sensing will become one of the principle media used for the systematic survey of arid land resources. (Sherbrooke-Ariz)
W69-07356

A GEOMETRIC METHOD TO SUBDIVIDE THE PATAPSCO FORMATION OF SOUTHERN MARYLAND INTO INFORMAL MAPPING UNITS FOR HYDROGEOLOGIC USE,
Maryland Geological Survey, Baltimore.
Harry J. Hansen.
Geol Soc Amer Bull, Vol 80, No 2, pp 329-336, Feb 1969. 8 p, 5 fig, 23 ref.

Descriptors: *Stratigraphy, *Coastal plains, *Aquifers, *Maryland, Hydrologic data, Mapping, Geologic mapping, Cross-sections, Transmissivity, Sands.
Identifiers: Patapsco Formation (Maryland).

The Patapsco Formation of southern Maryland is a thick, heterogeneous sequence of unconsolidated rocks occurring in the upper part of the Potomac Group. Experience suggests that it functions as a multi-aquifer unit of hydraulic complexity. In the absence of definitive geologic criteria an adaptation of Haites' (1963) technique of perspective correlation is used to subdivide the Patapsco Formation into consistently defined mapping units. These units are useful for delineating vertical and horizontal changes in such parameters as sand percentage and coefficient of transmissibility. (Knapp-USGS)
W69-07387

DETERGENTS AND GROUNDWATER SUPPLY (FRENCH),
CERH Montpellier (France). Dept. of Sciences.
For primary bibliographic entry see Field 05B.
W69-07390

POTENTIAL ECONOMIC BENEFITS FROM THE USE OF RADIOISOTOPES IN FLOW MEASUREMENTS THROUGH HIGH-HEAD TURBINES AND PUMPS,
Bureau of Reclamation, Denver, Colo. Div. of Project Investigations.
For primary bibliographic entry see Field 08C.
W69-07404

PIEZOMETER DETECTION OF SATURATED INTERFLOW IN SOILS,
Tennessee Valley Authority, Knoxville.
Roger P. Betson, John B. Marius, and Robert T. Joyce.
Soil Science Society of America Proceedings, Vol 32, No 4, pp 602-604, July-August 1968. 2 p, 1 fig, 1 tab, 3 ref.

Descriptors: *Piezometers, Instrumentation, Soil water, *Saturated flow, Watershed hydrology.

Piezometers were used as saturated interflow detection devices in a study of partial watershed contribution to storm runoff. Saturated interflow was detected along the AB-horizon interface in clay loam soils with shallow A horizons. The results of the study showed that at least under some soil conditions piezometers can be useful in determining the extent of saturated flow within a watershed. The occurrence of this flow will normally be confined to the shallow A-horizon regions.
W69-07463

A TECHNIQUE TO INFER ATMOSPHERIC WATER-VAPOR MIXING RATIO FROM MEASURED HORIZON RADIANCE PROFILES,
National Aeronautics and Space Administration, Langley Station, Va. Langley Research Center.
Thomas B. McKee, Ruth I. Whitman, and Jules J. Lambiotte, Jr.
NASA Tech Note D-5252, June 1969. 33 p, 7 fig, 5 tab, 12 ref.

Descriptors: *Meteorology, *Atmospheric physics, Air masses, Atmospheric pressure, Humidity, Solar radiation, Temperature, Weather data.
Identifiers: *Horizon radiance profiles, *Atmospheric water-vapor mixing ratio.

A technique is presented to infer atmospheric water-vapor mixing-ratio structure from measured horizon radiance profiles when a method exists for calculating radiance profiles. Inferred mixing-ratio accuracy for the 10-km to 35-km altitude range is shown when the computer program input data contain no errors and when the computer program input is perturbed by errors normally found in measurements. Water-vapor mixing ratios are inferred from horizon radiance profiles measured in the summer in an altitude range from 17 deg to 58 deg from NASA Project scanner flight. No significant altitudinal variation existed above an altitude of 18 km. Below 18 km an altitudinal variation does exist that is consistent with the large variations that are known to exist in the troposphere. The mixing ratio decreases with altitude to a minimum at a ranging from 3 km to 5 km above the tropo altitude. Above an altitude of 20 km the ratio shows a slight increase to 35 km. (
USGS)
W69-07491

A NEW METHOD OF INVESTIGATING I RECESSION CURVES,
Usk River Authority, Newport (England).
T. R. E. Chidley.
J Inst Water Eng, Vol 23, No 3, pp 177-18
1969. 10 p, 8 fig, 8 tab, 3 ref.

Descriptors: *Recession curves, *Base *Streamflow forecasting, Hydrographs, levels, Groundwater movement, Runoff, S groundwater relationships.
Identifiers: Stream recession, River USK (U.

A statistical method of analyzing and fore river recession curves within 3 days after the tion of rain is presented. The principle und the method is to isolate the rate of recession relate this by regression analysis to para which physically are known to affect the recession. River discharge (implicitly a mea groundwater levels), antecedent condition season were used. Other more objective p ters could be used. The basis for the met completely munerical, and any recession cu be analyzed automatically from a set of rainf runoff data by either a computer or a trained All subjectivity has been removed from the a except in the choice of parameters believed fect rate of recession. (Knapp-USGS)
W69-07493

NEW CONCEPTS IN THE DOMAI RECORDING GAGES IN 1968: DE PRESENTLY UTILIZABLE, PROTOTYPE DESIGNS (FRENCH),
Office de la Recherche Scientifique et Tec Outre-Mer, Paris (France).
P. Dubreuil.
Cah ORSTOM, Ser Hydrol, Vol 5, No 4, p 1968. 21 p, 3 fig, 3 tab, 12 ref.

Descriptors: *Hydrometry, *Instrumen *Gages, *Design, *Design criteria, *Desig High water mark, Hydrometers, Gaging st Distribution, Industrial production, Low mark, Discharge measurement, Water suppl tomatic control, Automation, Pressure mea instruments.
Identifiers: *France, Recording gage.

The status of hydrologic recording gages in F their principal characteristics and their use various hydrogeological conditions are invest on the basis of field and laboratory data g earlier publications. The study shows the 1,220 hydrologic gaging stations in France 450 stations located in the rural areas. In g over 50% of the recording stations are equ with relatively modern devices not older t years. (Gabriel-USGS)
W69-07536

7C. Evaluation, Processing and Publication

THEORETICAL ANALYSIS OF REGI GROUNDWATER FLOW, 3. QUANTITA INTERPRETATIONS,
For primary bibliographic entry see Field 02F
W69-07339

A SEMIAUTOMATIC METHOD FOR RE ING STREAMFLOW RECORDS,
Utah State Univ., Logan. Dept. of Forest Scie
George E. Hart.
J Soil and Water Conserv, Vol 24, No 2, pp
Mar-Apr 1969. 3 p, 3 fig, 4 ref.

riptors: *Hydrograph analysis, *Data ssing, *Discharge (Water), *Computer pro- s, Analytical techniques, Stream gages, ologic data, Runoff, Rainfall-runoff relation-

ifiers: Semiautomatic stream-gage data reduc-

niautomatic digital computer system for use in projects is designed to reduce streamflow ds and interpret hydrographs. Time and -level coordinates are transferred directly the field record to computer cards by manual unching, using the analyst's judgement as to etail required to characterize the hydrograph. t 30 man-weeks were needed to transcribe 40 -yrs of record in a recent study. A FORTRAN ogram is available from the author to use in cing the punched-card data. It has a variable scale, calculates discharges, and detects input s. (Knapp-USGS)
-07376

ROLOGIC AND CLIMATOLOGIC DATA, , SALT LAKE COUNTY, UTAH,
ogical Survey, Salt Lake City, Utah.
rimary bibliographic entry see Field 02B.
-07407

EOROLOGICAL AND HYDROLOGICAL UGHT IN RARITAN RIVER BASIN IN JERSEY,
ers - The State Univ., New Brunswick, N. J.
r Resources Research Inst.
rimary bibliographic entry see Field 02B.
-07457

ER RESOURCES OF NORTH CAROLINA: INVENTORY OF INFORMATION AND A,
h Carolina Univ., Chapel Hill.
erick E. McJunkin, Mary J. Coe, and Bruce A.
r.
rt No. 22, Water Resources Research Institute e University of North Carolina 1968. 384 p, 1 1998 ref, 6 append. OWRR Project A-018-NC.

riptors: *Water resources, *North Carolina, mentation, *Bibliographies, *Data collec- , *Publications.

mprehensive inventory and index to all printed mation and data relevant to North Carolina's r resources. Includes author index, subject in- and geographic index all arranged alphabeti- (Howells-NC)
-07478

THREE DIMENSIONAL STUDY OF AMETERS RELATED TO THE CURRENT RIBUTION IN LAKE ROOSEVELT,
lle-Northwest, Richland, Wash. Pacific hwest Lab.
rimary bibliographic entry see Field 02H.
-07481

OMATIC CALCULATION OF MEAN ITHLY AND ANNUAL PRECIPITATION IN CH SOME MEASUREMENTS ARE ING (FRENCH),
e de la Recherche Scientifique et Technique e-Mer, Paris (France). Dept. of Hydrological arch.
coulon, and J. Cruette.
ORSTOM, Ser Hydrol, Vol 5, No 4. pp 43-56, . 14 p, 2 fig, 5 tab, append.

riptors: *Mathematical studies, *Mathemati- odels, *Precipitation (Atmospheric), *Rain, ologic data, Statistical methods, Automation, ng stations, Rain gages, High water mark, Low r mark, River basins, Watersheds (Basins). ifiers: Rain gage data.

This article discusses the application of POH-106 program for the calculation of mean annual and monthly precipitations on the basis of Thiessen's method and using the charts COH-102 of total rain gage data. This program is considerably more complete than the POH-104 program utilizing the daily precipitation values and is, in reality, a method of substitution by using rain gage observations. The application of the method, however, is conditioned by the lengths of distance intervals between the rain gage stations. (Gabriel-USGS)
W69-07538

DIGITAL SIMULATION OF CHANNEL NETWORKS,
IBM Watson Research Center, Yorktown Heights, N. Y.
For primary bibliographic entry see Field 02E.
W69-07542

ANALYSIS OF WATER-RESOURCE SYSTEMS,
American Water Resources Association, Urbana, Ill.
For primary bibliographic entry see Field 06A.
W69-07562

08. ENGINEERING WORKS

8A. Structures

LARGE RIVER DAMS (FRENCH),
Rhone National Co. (France).
Marc Henry.
Travaux, Vol 52, No 409, pp 191-197, Apr 1969. 7 p, 3 fig.

Descriptors: *Dams, *Streamflow, *Reservoirs, Floods, Solid wastes, Sediment discharge, Water circulation, Velocity, Dam sites, Embankments, Equipment, Alluvium.
Identifiers: Large river dam.

This article presents pertinent engineering and hydrological considerations for proper construction of dams across large rivers. The article contains the following brief chapters; (1) raising the water levels in the upper reaches; (2) elimination of water circulation sediments. (3) particular characteristics of river dams; (4) water-gate types; and (5) dams built on alluvium foundations. (Gabriel-USGS)
W69-07365

DESIGN OF DAMS FOR MILL TAILINGS,
Bureau of Mines, Washington, D. C.
For primary bibliographic entry see Field 05G.
W69-07473

SOME NOTES ON THE RATIONAL METHOD OF STORM DRAIN DESIGN,
American Society of Civil Engineers, Cambridge, Mass. Engineering Sciences Lab.
For primary bibliographic entry see Field 02A.
W69-07482

SEWERED DRAINAGE CATCHMENTS IN MAJOR CITIES,
American Society of Civil Engineers, Cambridge, Mass. Engineering Sciences Lab.
For primary bibliographic entry see Field 02A.
W69-07486

8B. Hydraulics

RUBBLE MOUND BREAKWATER BEHAVIOR UNDER WAVE ACTION (FRENCH),
Electricite de France. Dept. of Studies and Research.
Adelkis J. Rogan.
Elec De France, Bull de Dir Etud et Rech, Ser A, Suppl No 1, 1968. 153 p, 31 fig, 11 tab, 1 photo, 65 ref, 4 append.

Descriptors: *Breakwaters, *Dams, *Water (Water), Construction, Stability, Mathematical models, Model studies, Equilibrium, Deterioration, Statistical methods, Stochastic processes, Frequency, Probability, Reynolds number, Floods, Water levels, Density, Viscosity, Talus.
Identifiers: Wave action-jetty behavior.

The study is a monograph on the behavior of jetties under the wave action of regular swells and irregular wind waves. After giving a critical review of several classical and standard formulas, the author develops simple formulas based on the use of the continuity equation, Navier-Stokes equations and introducing the 'wave-action-time' paramcter. These modified formulas were applied to a series of model tests using a flume and a paddle producing swells during which the height of waves (H), their period (T), and destruction time (t) of the breakwater model were recorded. Another series of experiments was conducted by using a flume with removable cover and a fan. The study shows that the destructive wave height is very closely equal to the significant height H, used in many countries as the design wave height. In general, certain strength limits can be evaluated for the structures with the aid of the 'destruction-risk criterion' defined in the model tests and statistical analysis of wave recordings at a proposed jetty site. (Gabriel-USGS)
W69-07535

DESIGN OF SEWER SYSTEMS,
Colorado State Univ., Fort Collins.
Mell Holland.
Proc, Nat Symp Anal Water-Resource Syst, pp 218-224, July 1-3, 1968. 7 p, 4 fig, 4 ref.

Descriptors: *Sewers, *Design flow, *Pipes, *Optimization, *Linear programming, Sanitary engineering, Constraints, Hydraulics, Network design.
Identifiers: *Tree network, *Looped network.

Linear programming solutions to the problem of optimal design of a sewer system were presented. The objective was to minimize the total cost of materials and placement. Linear programming techniques were used to determine the optimal layout design. Three alternative approaches to the design of sewer systems were considered. The first was the current approach based on a selected layout for which a tentative set of pipe sizes and slopes was chosen on the basis of engineering experience and judgment. This approach did not include an explicit optimization. The second approach was a two-phased approach in which the layout selection and sthe specifications for the pipe sizes and slopes were optimized in separate steps. The selection of the layout was found to be the more difficult of the two phases. The third and optimal alternative included the simultaneous optimization of the layout, the pipes and the slopes. There was no procedure available for this approach. For main entry see W69-07562. (Thiuri-Cornell)
W69-07574

8C. Hydraulic Machinery

POTENTIAL ECONOMIC BENEFITS FROM THE USE OF RADIOISOTOPES IN FLOW MEASUREMENTS THROUGH HIGH-HEAD TURBINES AND PUMPS,
Bureau of Reclamation, Denver, Colo. Div. of Project Investigations.
Edmund Barbour.
Bur Reclam Eng Monogr No 38, 1969. 25 p, 6 fig, 5 tab.

Descriptors: *Pumps, *Hydraulic turbines, *Flow measurement, *Tracers, *Radioisotopes, Pump testing, Hydraulics, Performance, Hydraulic equipment, Instrumentation, Tracking techniques, Pipe flow, Flowmeters.

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Identifiers: *Conduit flow metering.

The uses of radioisotopes to measure flow of fluids through high-pressure turbines and pumps is summarized as part of a program for the development of simple, accurate, inexpensive flow-measurement systems. Other methods are briefly reviewed. Of the 11.6 million kw capacity in Bureau of Reclamation powerplants, 3 million kw are considered amenable to radioisotope flow measurements. If the method makes operation 1/2% nearer to potential efficiency, a gain of $2 million in 10 yrs is possible. Pumps are more difficult to test. Of 1.7 million hp, about 1 million may be tested by radioisotope methods, yielding as much as 1% greater efficiency at a saving of $1.3 million in 10 yrs. Good flow rate measurement will also allow improved equipment design with large savings. (Knapp-USGS)
W69-07404

8G. Materials

TRANSPORTATION OF DEMINERALIZED WATER,
San Diego Dept. of Utilities, Calif.
For primary bibliographic entry see Field 03A.
W69-07524

8I. Fisheries Engineering

GAME AND FRESHWATER FISH.

Md Ann Code art 66c secs 200 to 209, 214 to 218, 222, 224, 225, 226 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Fishing, *Fish management, *Administrative agencies, Freshwater fish, Fish, Fish conservation, Fish hatcheries, Farm ponds, Fish stocking, Fish establishment, Fish ladders, Dams, Trout, Permits, Legislation, Legal aspects, Water law, Water policy, Jurisdiction, Ponds, Fresh water, Recreation, Tidal waters.
Identifiers: Nontidal waters, Seasons (Fishing), Shad.

The lines separating tidal and nontidal waters within the state are described. Fish ladders must be built when dams are placed across streams. Preventing fish from having free access up and down streams is unlawful. Dynamiting streams is illegal. The Game and Inland Fish Commission has jurisdiction to establish regulations concerning fishing in nontidal waters. Seasons for all fish are presently year long. All persons fishing for trout in designated trout streams must purchase a trout stamp in addition to their regular fishing license. Fishing at night in trout streams and taking shad by means other than angling are prohibited. There are a number of other general restrictions on fishing in nontidal waters. Fishing on private ponds stocked by the owner is illegal. Persons who raise game fish must purchase an annual permit. A license is necessary for operation of a pond where fishing is permitted on payment of a fee. The commission t
take fish for purpose of propagating in capti
and returning the fry to public waters and
maintain suitable fish hatcheries for this purp
There are special regulations for Deep Creek L
and Caroll County. (Johnson-Fla)
W69-07690

10. SCIENTIFIC AND TECHNICAL INFORMATIO

**WATER RESOURCES OF NORTH CAROLI
AN INVENTORY OF INFORMATION A
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North Carolina Univ., Chapel Hill.
For primary bibliographic entry see Field 07C.
W69-07478

**BIBLIOGRAPHY OF HYDROLOGY OF T
UNITED STATES AND CANADA,**
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
W69-07517

**QUANTITATIVE FORMULATION OF STRE
AND WATERSHED MORPHOLOGY,**
Pennsylvania State Univ., University Park. Dep
Civil Engineering.
For primary bibliographic entry see Field 04D.
W69-07546

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W69-07528 02J

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W69-07432 02H

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(4) University of Wisconsin - Eutrophication	W69-07423 -- W69-07443 W69-07480 and W69-07576	23
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Main I, A System of Computerized Models for Calculating and Evaluating Municipal Water Requirements (2 vols)		Hittman Assoc., Inc.	No. 9, p. 56, W69-03201
Main I, A System of Computerized Models for Calculating and Evaluating Municipal Water Requirements (two magnetic tapes $75 each: tape one, Library of Water Usage Parameters, tape two, Source Language Programs)		Hittman Assoc., Inc.	No. 9, p. 56, W69-03202
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Estimation of Recreational Benefits at Some Selected Water Development Sites in California	Leonard Merewitz	Planmetrics, Inc.	No. 9, p. 51, W69-03578
Effective Water Resource Management		TRW Systems, Inc.	No. 10, p. 41, W69-03702
Velocity-Distributions in Straight Rectangular Channels	Chin-lien Yen	Hydronautics, Inc.	No. 10, p. 4, W69-03703
A Discussion of the Dispersivity Tensor for a Turbulent Uniform Channel Flow	C. Dagan	Hydronautics, Inc.	No. 10, p. 4, W69-03704
Calculation of Dispersion Coefficient in Straight Prismatic Streams	C.L. Yen C. Elata	Hydronautics, Inc.	No. 10, p. 4, W69-03705
Urban Water Resources Research; Systematic Study and Development of Long-Range Plans, First Year Report, September 1968		American Society of Civil Engineers	No. 9, p. 50, W69-03506

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VOLUME 2, NUMBER 19
OCTOBER 1, 1969

W69-07700 -- W69-08126

Selected Water Resources Abstracts is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the Clearinghouse for Federal Scientific and Technical Information (CFSTI) of the Bureau of Standards, U. S. Department of Commerce. It is available to Federal agencies, contractors, or grantees in water resources upon request to: Manager, Water Resources Scientific Information Center, Office of Water Resources Research, U. S. Department of the Interior, Washington, D. C. 20240. Annual subscription is $22.00 (domestic), $27.50 (foreign), single copy price is $3.00. Certain documents abstracted in this journal can be purchased from the Clearinghouse at the prices indicated in the entry. Prepayment is required.

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

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VOLUME 2, NUMBER 19
OCTOBER 1, 1969

W69-07700 -- W69-08126

Use of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.

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- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the FWPCA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

In cooperation with the Federal Water Pollution Control Administration, the following "centers of competence" have been established:

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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A. Properties

PPLICATION OF THE HYDRAULIC ANALO-Y TO FIELD AMPLIFIER DESIGN (FRENCH),
epartment of Sciences, Toulouse (France).
or primary bibliographic entry see Field 02A.
/69-08020

2. WATER CYCLE

A. General

DVANCES IN HYDROSCIENCE.

how, Ven Te, Editor. Advances in Hydroscience, ol 5, 1969. 305 p, 127 fig, 18 tab, 383 ref, 2 in-ex.

escriptors: *Reviews, *Bibliographies, *Ground-ater movement, *Stochastic processes, *Snow, eepage, Infiltration, Snowpacks, Mathematical odels, Model studies, Mathematical studies, Soil ysics, Open channels.
lentifiers: Stochastic hydrology, Snow physics.

ecent advances in stochastic hydrology, subsur-ce flow, and snow physics are reviewed. tochastic hydrology helps in the design of water esource systems by use of analytical or simulation odels. Mathematical and physical work in open-annel seepage and in soil water movement per-its good water conveyance design work and sub-rface water determinations. Recent work in snow hysics includes study of metamorphism, diffusion, apor transport, and radiation properties. See also /69-07724 thru W69-07727. (Knapp-USGS)
/69-07723

IME SERIES ANALYSIS OF HYDROLOGIC ATA,
rizona Univ., Tucson. Office of Hydrology and Vater Resources.
or primary bibliographic entry see Field 07C.
/69-07724

IMULTANEOUS USE OF AN ANALOG SIN-LE-PURPOSE ELECTRONIC COMPUTER ND A PHYSICAL MODEL OF A VATERSHED,
rague Agricultural Univ. (Czechoslovakia). Dept. f Water Resources.
arcmir Nemec.
ymp on Use of Analog and Digital Computers in ydrol, Tucson, Ariz, Dec 1968, Int Ass Sci ydrol, Pub No 80, Vol 1, pp 10-14, 1968. 5 p, 2 g, 7 ref.

escriptors: *Analog computers, *Analog models, Model studies, *Hydrograph analysis, Floods, ainfall-runoff relationships, Hydraulic models, arametric hydrology, Mathematical models, outing, Flood routing.
lentifiers: Flood hydrographs.

o analyze the time element of flood hydrographs surface runoff, use is made of a single-purpose ectronic resistance-capacitance computer con-ining 6 RC units with a non-linearity element. he time lag constants of the computer are selected n the basis of measured time lags from a physical aled model of an experimental watershed on hich the floods are simulated by a sprinkler. The sulting hydrographs from the analog computer id the physical model are compared at various in-nsities and durations of rain. The study is directed ward an interconnection of the analog computer id the physical model. (Knapp-USGS)
/69-07743

WATERSHED SIMULATION BY ELECTRONIC ANALOG COMPUTER,
Utah Water Research Lab., Logan.
J. Paul Riley, Duane Chadwick, and Eugene Israelsen.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Int Ass Sci Hydrol, Pub No 80, Vol 1, pp 25-37, 1968. 13 p, 9 fig, 11 ref.

Descriptors: *Analog models, *River basin development, Water demand, Water supply, Hydrographs, Hydrograph analysis, Streamflow, Streamflow forecasting, Rainfall-runoff relationships, Resistance networks, Simulation analysis.
Identifiers: Watershed simulation.

At Utah State University the consequences of man-made hydrologic changes in drainage basins are being approached by electronic analog simulation. A model is developed for investigating the behavior or response of a dynamic prototype system subject to particular constraints and input functions. Simulation permits an examination of the composite system involving all processes occurring simultaneously. Thus, a model is not only an excellent exploratory tool, but also a direct aid to creative thinking. A model can greatly facilitate an appraisal of proposed changes within a prototype system. A fundamental requirement of a computer model of a physical system is that it simulate on a continuous basis all important processes and relationships within the system that it represents. The various functions and operations of the different parts of the system are interrelated by the concepts of continuity of mass and momentum. Many of the processes which occur in hydrologic systems can be represented by time-dependent differential equations. For the solution of this equation form, the analog computer is particularly adept because it can integrate problem variables on a continuous basis. Close agreement with observed outflow hydrographs has been achieved in several model experiments. Analog computer simulation seems capable of making substantial contributions both in the area of basic water related research, and also as a planning and management technique in seeking optimum use of existing water supplies. (Knapp-USGS)
W69-07744

ELECTROLYTIC TANK TYPE MODELS FOR PREDICTING THE POSITION OF THE GROUNDWATER TABLE AND THE LOSS OF RIVER DISCHARGES,
Research Inst. for Water Resources Development, Budapest (Hungary).
E. Varrok.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, pp 3-9, 1968. Int Ass Sci Hydrol, Pub No 80, Vol 1, pp 3-9, 1968. 7 p, 8 fig.

Descriptors: *Analog models, *Surface-groundwater relationships, Induced infiltration, Bank storage, Dams, Aquifers, Reservoirs, Resistance networks, Electrolytes, Model studies.
Identifiers: Hungary, Danube River, Resistivity models, Electrolytic analog models.

Groundwater levels on riverside areas may be predicted by electrolytic tank models and automatic devices. On the 73 km long stretch of the Danube River between river stations 1795 and 1868 km, hydroelectric development has been contemplated. Here the river flows on the ridge of an alluvial deposit, and influences the water table on both sides. On the right side an area of about 800 sq km is influenced. The gravel aquifer overlying the impermeable bottom is from 50 to 300 m deep. The area was reproduced in an electrolyte type model to 1:25,000 scale, with the bottom relief made of synthetic resin. The slope of the water surface in the rivers bordering and crossing the area, and also the anisotropy of the aquifer were taken into consideration. This model was used to predict the position of water table, its depth under the terrain, the discharge filtering into the draining canals and the total seepage loss from the river. For models of this type automatic equipment has been developed to find the preselected equipotential lines and follow them automatically, tracing their path on an adjacent drawing board to the scale of the model. (Knapp-USGS)
W69-07949

ELECTRICAL-ANALOG ANALYSIS OF THE HYDROLOGIC SYSTEM IN TUCSON BASIN, ARIZONA, U.S.A.,
Geological Survey, Tucson, Ariz.
For primary bibliographic entry see Field 02F.
W69-07950

THE MAR ANALOG COMPUTER FOR MODELLING HYDROLOGICAL SERIES BY THE MONTE CARLO METHOD,
G. G. Okroashvili, and G. G. Svanidze.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Int Ass Sci Hydrol Pub No 80, pp 81-86, 1968. 6 p, 5 fig, 4 ref.

Descriptors: *Analog computers, *Runoff forecasting, Monte Carlo method, Markov processes, Stochastic processes, Reservoir operation, Streamflow forecasting, Water management (Applied), Routing, Statistical methods.
Identifiers: *USSR.

An analog computer is used in the USSR for modelling annual runoff fluctuations, given the statistical characteristics of the rainfall-runoff relationship. The probability of storage of reservoirs may also be computed. A description of the computer is given and its operation is discussed. (Knapp-USGS)
W69-07954

DIGITAL COMPUTER SOLUTIONS FOR FLOOD HYDROGRAPH PREDICTION FROM RAINFALL DATA,
Technische Hochschule, Munich (West Germany).
Hydraulics Research Station Obernach.
Gert A. Schultz.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Int Ass Sci Hydrol, Pub No 80, Vol 1, pp 125-137, 1968. 13 p, 9 fig, 3 tab, 11 ref.

Descriptors: *Mathematical models, *Computer models, *Digital computers, *Rainfall-runoff relationships, *Flood forecasting, Synthetic hydrology, Hydrographs, River forecasting, Rainfall disposition, Computer programs, Unit hydrographs.
Identifiers: Germany, Hydrograph synthesis.

A linear distributed-system model for flood hydrograph synthesis was applied to 2 characteristic test catchments (up to 700 sq mi in area) in central Europe, one of which was an Alpine watershed. The method uses very small elements, both in time and space, which made the use of a digital computer inevitable. The calculations were performed by a Telefunken TR 4 computer (80,000 operations/sec) using an ALGOL code program. The mathematical model uses as input information rainfall data consisting of temporal and spatial distribution and catchment characteristics. The output consists of a digital flood method in which the hydrological deviation between the observed and the synthesized hydrograph is calculated. The 30 synthesized floods were compared with the results gained by applying the conventional Unit Hydrograph method (also calculated by an ALGOL-code computer program) to the same floods. The results show that the new model produces a higher average accuracy than the conventional Unitgraph method. Furthermore it was possible to show that the accuracy of the model in contrast to the Unitgraph method, did not deteriorate with increasing catchment area. (Knapp-USGS)
W69-07958

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DETERMINATION OF THE RUNOFF HYDROGRAPH ON A DETERMINISTIC BASIS USING A DIGITAL COMPUTER,
Technical Univ. of Budapest (Hungary).
M. Kozak.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Int Ass Sci Hydrol, Pub no 80, Vol 1, pp 138-151, 1968. 14 p, 8 fig, 10 ref.

Descriptors: *Rainfall-runoff relationships, *Mathematical models, *Computer models, *Digital computers, Computer programs, Synthetic hydrology, Rainfall disposition, Rainfall intensity, Hydrographs, Hydrograph analysis.
Identifiers: Hungary.

The two main prerequisites for the exact determination of runoff discharge from catchments are the knowledge of the linear charge and the computation of resulting flow conditions in the canal network with due allowance for the non-steady character of flow. The catchment area is divided first into catchment strips and these in turn into fields having homogeneous parameters. For deriving a solution for the problem the equation expressing the mean velocity of sheet flow is included. The linear charge is obtained as the combined effect of runoff originating from catchment fields situated successively downstream. Allowance for the main parameters of each field--which vary with respect to location and time alike and affect runoff conditions--is made by the division into fields. Allowance can also be made for variations of rainfall intensity in both time and space. For solving the resulting differential equation a mathematical program has been compiled, and its application is illustrated by a representative example. From the results of mechanical computation it could be concluded that essential, but hitherto not clearly understood features of the involved hydraulic phenomenon, are revealed in greater detail by computations relying on more exact theoretical foundations. (Knapp-USGS)
W69-07959

APPLICATION OF THE HYDRAULIC ANALOGY TO FIELD AMPLIFIER DESIGN (FRENCH),
Department of Sciences, Toulouse (France).
J. Dat, and C. Fonade.
La Houille Blanche, Vol 24, No 1, pp 35-43, 1969. 9 p, 5 fig, 16 ref.

Descriptors: *Analog models, *Mathematical studies, *Mathematical models, Hydraulic design, Fluid mechanics, Runoff, Channels, Compressible flow, Pressure, Stokes law, Temperature, Energy equation, Viscous flow, Velocity, Heat flow.
Identifiers: *Hydraulic analogy design.

The application of the hydraulic analogy to hydrological problems was investigated on the basis of the solution of 6 equations: (1) continuity; (2) Navier and Stokes' 3 equations of motion; (3) conservation of energy; and (4) pressure-volume-temperature equation. The study shows that, by neglecting fluid viscosity, the polyotropic index (the ratio of specific heat at constant pressure to specific heat at constant volume) is 2. The study also shows that by assuming geometrical similarity there is an analogy between the depth of water in a free-surface model and the density of the fluid under pressure. The last conclusion is equivalent to setting the pressure flow Mach number equal to the Froude number for free-surface flow. An example given in the article indicates that this analogy can be achieved in practice. (Gabriel-USGS)
W69-08020

FUNCTION SPACE APPROACH TO PARAMETER IDENTIFICATION IN DISTRIBUTED SYSTEMS,
Hitachi Research Lab., Ibaraki (Japan); and California Univ., Los Angeles.
Yukio Kawamoto, and Jacques J. Vidal.
Water Resources Res Center Publication (undated). 4 p, 1 fig, 3 ref. OWRR Project No A-032-CAL.

Descriptors: *Mathematical models, *Digital computers, *Analytical techniques, *Computer programs, Data processing, Synthetic hydrology, Numerical analysis, Parametric hydrology, Simulation analysis.
Identifiers: Partial differential equations.

The solution of partial differential equations describing realistic physical problems can place a heavy burden on even the largest and fastest computers. Moreover, if the problem is one of synthesis such as parameter identification, repeated solving of the equations are called for, rendering the computing outlook even more critical. This is especially true if the parameter values at each node are considered independent elements of a multivariable system. The alternate approach discussed here reduces the problem to one of optimal control in function space. A compact algorithm is derived to identify parameters that are distributed functions by iterative updating over the whole space and time domains. (Knapp-USGS)
W69-08023

THE EFFECT OF CASPIAN SEA LEVEL OSCILLATIONS ON EVAPORATION INTENSITY FROM ITS SURFACE (RUSSIAN),
For primary bibliographic entry see Field 02D.
W69-08030

A NUMERICAL MODEL FOR THE SIMULATION OF TIDAL HYDRODYNAMICS IN SHALLOW IRREGULAR ESTUARIES,
Texas Univ., Austin. Hydraulic Engineering Lab.
For primary bibliographic entry see Field 02L.
W69-08112

HYDROLOGIC ANALYSIS FOR LAKE ONTARIO: STOCHASTIC ASPECTS OF EVAPORATION.
Cornell Univ., Ithaca. School of Civil Engineering.
For primary bibliographic entry see Field 02D.
W69-08116

2B. Precipitation

SPECIALIZED ANALOG COMPUTERS FOR HYDROLOGICAL CALCULATIONS AND FORECASTS,
Hydrometeorological Centre, Moscow (USSR).
For primary bibliographic entry see Field 07C.
W69-07952

HYDROLOGIC REGIONS IN BULGARIA (BULGARIAN),
For primary bibliographic entry see Field 02E.
W69-07979

TROPICAL RAINFALL VARIATIONS OVER A SMALL AREA,
University Coll., Dar-es-Salaam (Tanzania). Dept. of Geography.
I. J. Jackson.
J Hydrol, Vol 8, No 1, pp 99-110, May 1969. 11 p, 2 fig, 3 tab, 5 ref.

Descriptors: *Rainfall, *Rainfall disposition, Rain gages, Sampling, Statistical methods, Regression analysis, Tropic, Climatic zones, Humid climates, Storms.
Identifiers: Tanzania.

The large spatial variation of daily and monthly rainfall over an area of about 2 sq mi is analyzed. The variation is the result of storm tracks rather than relief. Little difference was found in the assessment by 3 different methods of mean depth of rainfall over the area. The 10 rain gages used were found to be barely adequate for an accurate estimation of mean depth. (Knapp-USGS)
W69-08007

2C. Snow, Ice, and Frost

ADVANCES IN HYDROSCIENCE.
For primary bibliographic entry see Field 02A.
W69-07723

RECENT STUDIES ON SNOW PROPERTIES
Army Terrestrial Sciences Center, Hanover, N.
Yin-Chao Yen.
Advance in Hydroscience, Vol 5, pp 173-
1969. 42 p, 21 fig, 4 tab, 33 ref.

Descriptors: *Snow, *Physical properties, Den
Diffusivity, Optical properties, Thermal con
tivity, Albedo, Avalanches, Density stratificatio
Identifiers: Snow metamorphism, Snow structu

Recent work in snow metamorphism, sinte
thermal properties, and radiation properties is
marized. Methods for determining thermal con
tivity and water vapor diffusivity are discus
Theoretical and measured values of thermal
ductivity, thermal diffusivity, vapor diffusion,
radiant energy transport in snow are discussed
compared. For main entry see W69-07723.
napp-USGS)
W69-07726

GLACIER MOVEMENT IN THE MIR AREA (RUSSIAN),
Arkticheskii i Antarkticheskii Nauchno
ledovatelskii Institut, Leningrad (USSR).
Ya P. Koblents.
Informatzionnyy Byulleten' 70, Sovetskoy Ant
ticheskoy Ekspeditsii, pp 32-35, 1968. 4 p, 1 f
tab, 2 ref.

Descriptors: *Glaciers, *Antarctic, Mapp
Snow, Temperature, Movement, Velocity, Fiss
(Geology), Erosion.
Identifiers: Antarctic glacier movement.

Glacier movements in the vicinity of the Mi
station of Antarctica were investigated by usi
careful mapping of the pertinent points of the
tion. The study shows that the maximum displ
ment of the surveyed objects was 7 m during th
study years. Such a speed of motion, however,
not be considered as dangerous for the prese
tions of buildings at the station. (Gabriel-USGS
W69-07751

STRUCTURE, BASIC PROPERTIES, A STRENGTH OF MARINE ANTARCTIC (RUSSIAN),
Leningrad State Univ. (USSR).
V. Kh. Buynitskiy.
Informatzionnyy Byulleten' 65, Sovetskoy Ar
kicheskoy Ekspeditsii, pp 90-104, 1967. 15 p, 4
3 tab, 21 ref.

Descriptors: *Ice, *Antarctic, *Strength, *St
ture, Frazil ice, Snow, Crystallization, Wi
Salinity, Density, Summer, Seasonal, Temperat
Identifiers: Marine Antarctic ice.

Marine Antarctic ice properties were investig
on the basis of earlier publications and the re
are given as the curves of ice salinity, density,
strength, as a function of season, temperature
oceanic depth. The study shows that the densi
ice varies from 0.810 to 0.950 and its vertical
tribution in its annual ice layer is considerably
ferent from the vertical salinity distribution.
strength of Antarctic ice in bending varies from
to 47. kg/sq cm, as a result of an extremely c
plicated and heterogeneous structure of the
tarctic ice. (Gabriel-USGS)
W69-07767

STORBREEN CLACIER IN VOTUNHEIM NORWAY,
Norsk Polarinstitutt, Oslo.

lav Liestol.
orsk Polarinstitutt Nkr No 141, 1967. 63 p, 43 , 5 tab, 33 ref.

escriptors: *Glaciers, Mass, Ablation, Hydrologic ata, Mathematical studies, Meteorological data, notogrammetry, Mapping, Convection, Radia- on, Condensation, Summer, Firn, Sediment load, emperature, Density, Snow, Snowmelt, Freezing, elocity.
entifiers: *Norway, Storbreen glacier.

his study represents the results of the investiga- ons conducted during the 1949-1965 period and nsisting of glacio-meteorological observations d the measurements of accumulation, ablation, d mass balance taking place in the Storbreen lacier area. The study shows a good agreement etween the mass balance calculated on the basis volume calculations from accurate photogram- etric maps and the balance evaluated from direct servations. The calculated values of mass ilance are also in good agreement with the length riation of different glaciers. The article also gives me data on the glacier movement and its sedi- ent load. (Gabriel-USGS)
69-07768

ESEARCH ON GLACIER ACTIVITY (GER- AN),
IEL UNIV. (West Germany).
erhard Vorndran.
hr Geogr Instit der Univ Kiel, Vol 29, No 1, 968. 131 p, 33 fig, 19 tab, 235 ref.

escriptors: *Glaciers, *Alpine, *Climates, *Hyp- metric analysis, Climatic data, Mapping, Snow rvey, Ice, Mathematical studies, Glacial drift, Ac- elerated erosion, Altitude, Snow cover, Cirques, lovement.
lentifiers: *Alps (Eastern), German glacier activi- .

laciological research in the Eastern Alps Silvretta group) in 1966 and 1967 shows that bout 1860, when the last glacier maximum was eached, the climatic snow line was 100 m lower han now. The ice-covered area was twice as large s in 1952 - 59. In 100 yr, the permanent glacier etreat was interrupted only once by a short ad- ance in 1915-20. After 1860 large glaciers quickly st in volume because they extended 450 m, or ore, below snow line, but because of their hickness (greater than 100 m) only a small area ecame ice free. About 1920 the unretarded laciers advanced while the tongue glaciers emained stationary. Hypsographic curves of the ost retarded glaciers are convex whereas those of he cirque glaciers are concave. (Lang-USGS)
V69-07968

HYSICS OF ICE,
IcGill Univ., Montreal (Quebec). Dept. of hysics.
lton R. Pounder.
Oxford, Pergamon Press Ltd, 1965. 151 p, 31 fig, 5 ab, 70 ref.

Descriptors: *Ice, *Freezing, *Melting, Sea ice, Lake ice, Streams, Frazil ice, Cryology, Crystals, ce breakup, Ice loads, Ice jams.
Identifiers: *Ice physics, *Ice chemistry, Ice echanics.

The present state of knowledge of the structure and roperties of ice is outlined in a book written rimarily for use by readers with knowledge of asic mathematics, physics, and chemistry. The opics discussed include sea ice, ice drift, ice con- rol, crystallography, mechanical properties, ther- al properties, chemical properties, and ice-cover rowth and decay. (Knapp-USGS)
V69-08057

2D. Evaporation and Transpiration

PEAK FLOW REQUIREMENTS FOR SPRINKLER IRRIGATION OF ORCHARDS AS AFFECTED BY SOIL TEXTURE AND PEAK EVAPOTRANSPIRATION,
Department of Agriculture, Summerland (British Columbia).
For primary bibliographic entry see Field 03F.
W69-07780

EVAPOTRANSPIRATION BY WOODY PHREATOPHYTES,
Geological Survey, Carson City, Nev.
Otto M. Grosz.
Nev Dep Conserv and Natur Resources, Div of Forest, 10th Progr Rep, pp 1-5, Apr 1969. 5 p, 1 fig, 2 tab.

Descriptors: *Evapotranspiration, *Phreatophytes, *Nevada, Lysimeters, Soil moisture, Water table, Water-level fluctuations, Rabbitbrush, Willow trees.
Identifiers: *Winnemucca (Nev), Greasewood, Wildrose.

A lysimeter study near Winnemucca, Nev. was initiated in 1959 to measure water consumption by greasewood, willow, wildrose, and rabbitbrush. In the 1968 season, July maximum temperature was 93 deg F and the minimum was 53 deg F, slightly above the normal. August temperatures were 9 deg below normal. Water use, soil moisture, and evaporation were measured periodically and the 1968 data are tabulated. Monthly temperature, rainfall, and pan evaporation are shown graphically. (Knapp-USGS)
W69-07928

THE EFFECT OF CASPIAN SEA LEVEL OSCILLATIONS ON EVAPORATION INTENSITY FROM ITS SURFACE (RUSSIAN),
R. L. Reyfman.
Izv Acad Nauk, Azerboydzhanskoy, SSR, No 5, pp 121-127, 1968. 7 p, 1 fig, 9 ref.

Descriptors: *Evaporation, *Evaporation control, *Sea level, Water balance, Water loss, Water supply, Runoff, Hydrologic properties, Mathematical models, Humidity, Wind velocity, Ice, Freezing, Temperature.
Identifiers: *Caspian Sea, Surface evaporation.

Caspian Sea surface evaporation was investigated on the basis of earlier publications and application of the V.S. Samoylenko evaporation formula (1963), by connecting an evaporation layer in mm, mean monthly air-vapor pressure deficit in mbar, and mean wind velocity in m/sec. On the basis of the analysis of the available material and assuming some probable evaporation changes for various levels of the Caspian Sea, a schematic map of probable evaporation values was constructed for a two-meter decrease of the Caspian Sea level. The study shows that under present conditions of measurement accuracy a 2-3 meter decrease in the Caspian Sea level would not affect the volume of evaporated water over the Caspian Sea surface. (Gabriel-USGS)
W69-08030

HYDROLOGIC ANALYSIS FOR LAKE ONTARIO: STOCHASTIC ASPECTS OF EVAPORATION.
Cornell Univ., Ithaca. School of Civil Engineering.

Research Project Technical Completion Report No 12, of the Water Resources and Marine Sciences Center, June, 1969. 75 p, 12 tab, 15 fig, 52 ref. OWRR Project A-009-NY.

Descriptors: *Stochastic processes, *Evaporation, Mass transfer, Model studies, Hydrologic budget, *Lake Ontario, Hydrologic cycle, Water balance.
Identifiers: *Lake hydrology.

Before a complete analysis can be made of Lake Ontario as a hydrologic system, a sufficiently accurate estimate must be available of the evaporation component of the hydrologic cycle. Therefore, monthly mean values of evaporation from Lake Ontario for the period 1872-1965 were generated by a mass-transfer procedure. Available on-shore recorded meteorological data were adjusted to obtain approximate over-lake values. The mass-transfer coefficient was calculated with an equation by Harbeck (1962) relating it with water surface area. Correlation and spectral analyses showed that the annual cycle was predominating in the evaporation--and in the related meteorological time series. Evaporation is usually high in fall and winter and low in spring and summer. A warming trend was observed in the air temperature and a drying trend in the relative humidity series. Cross correlation and cross spectral analyses showed a close relationship between evaporation anomalies and the related meteorological parameters. A first order Markov model described adequately the evaporation, air temperature and relative humidity anomalies whereas a second order model could fit the wind speed and water surface temperature anomalies. Comparison of the mass-transfer evaporation data with Morton's (1967) water-budget estimates revealed that on the average the two methods are comparable. The water-budget method yields higher evaporation estimates in the summer and lower estimates in the winter.
W69-08116

2E. Streamflow and Runoff

ON THE HIGH REYNOLDS NUMBER FLOW OVER A WAVY BOUNDARY,
California Univ., San Diego, La Jolla. Inst. of Geophysics and Planetary Physics.
Russ E. Davis.
J Fluid Mech, Vol 36, Part 2, pp 337-346, Apr 14, 1969. Contract No Nonr-2216 (29)-ONR, Grant No GA-849-NSF.

Descriptors: *Waves (Water), *Viscous flow, *Turbulent flow, *Fluid mechanics, Reynolds number, Laminar flow, Interfaces, Shear, Viscosity, Roughness (Hydraulic).
Identifiers: Shear flow, Rayleigh number.

The nature of a shear flow over a wavy boundary of small amplitude is investigated. It is found that if the viscosity is small, the nature of the flow is highly dependent on the wave amplitude. If the wave amplitude is truly infinitesimal, the flow is described by the Orr-Sommerfeld equation and in the neighbourhood of the critical layer viscous stresses are important even in the limit of vanishing viscosity. However, if the wave is sufficiently large, viscous stresses may be neglected even in the critical layer. An approximate solution of the inviscid equations of motion is obtained to describe the flow over a small but finite wave in the limit of infinite Reynolds number. (Knapp-USGS)
W69-07705

HYDROGRAPH SYNTHESIS BY DIGITAL COMPUTER,
Texas A and M Univ., College Station. Dept. of Meteorology.
Michael D. Hudlow, and Robert A. Clark.
ASCE Proc, J Hydraul Div, Vol 95, No HY3, Pap No 6555, pp 839-860, May 1969. 21 p, 15 fig, 3 tab, 20 ref, append.

Descriptors: *Hydrographs, *Synthetic hydrology, *Unit hydrographs, Hydrograph analysis, Mathematical models, Digital computers, Flood forecasting, Numerical analysis, Streamflow forecasting, Runoff forecasting, Mathematical studies, Statistical methods.
Identifiers: *Hydrograph synthesis.

Hydrograph synthesis is based on an investigation of runoff from small drainage basins in Texas, using a technique for determination of the temporal distribution of infiltration capacity. Correlations are made between a critical hydrograph parameter,

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lag, and basin characteristics. Also, correlations are made between basin characteristics and the coefficients from Snyder's synthetic unit-hydrograph equations. A method for fitting hydrograph data to mathematical functions is developed. A nonlinear least-squares method is presented for fitting the 7 points obtained by a modified Snyder procedure to the Pearson type III mathematical function. (K-napp-USGS)
W69-07706

FLOOD PLAIN INFORMATION-GOODNIGHT ARROYO, DRY CREEK AND WILD HORSE-DRY CREEK, PUEBLO, COLORADO.
Corps of Engineers, Albuquerque, N. Mex.
For primary bibliographic entry see Field 04A.
W69-07708

FLOOD PLAIN INFORMATION OF ARKANSAS RIVER AND TRIBUTARIES, RUSSELLVILLE AND DARDANELLE, ARKANSAS.
Corps of Engineers, Little Rock, Ark.
For primary bibliographic entry see Field 04A.
W69-07715

FLOOD PLAIN INFORMATION OF SWEETWATER RIVER, SAN DIEGO COUNTY, CALIFORNIA.
Corps of Engineers, Los Angeles, Calif.
For primary bibliographic entry see Field 04A.
W69-07716

FLOOD PLAIN INFORMATION OF CANY CREEK IN VICINITY OF JACKSON, MISSISSIPPI.
Corps of Engineers, Mobile, Ala.
For primary bibliographic entry see Field 04A.
W69-07717

FLOOD PLAIN INFORMATION OF MASON CREEK AT SALEM, VIRGINIA.
Corps of Engineers, Wilmington, N. C.
For primary bibliographic entry see Field 04A.
W69-07718

A WATER BUDGET OF THE CARSON VALLEY, NEVADA,
Geological Survey, Washington, D. C.
Arthur M. Piper.
Geol Surv Prof Pap 417-F, 1969. 8 p, 1 fig, 1 plate, 7 tab, 1 ref.

Descriptors: *Hydrologic budget, *Nevada, *Runoff, Streamflow, Evapotranspiration, Comsumptive use, Irrigation, Rainfall, Discharge (Water), Inflow, Water balance.
Identifiers: Carson Valley (Nev), Water budget.

The water budget of Carson Valley, Nevada is estimated. Total annual inflow is 363,500 acre-ft, outflow is 286,300 acre-ft, and consumption is 77,200 acre-ft. Total runoff is calculated on the basis of estimated horizontal and vertical runoff variation and gaged streamflow into the valley. Water consumption is also estimated for natural or non-irrigated conditions. (Knapp-USGS)
W69-07733

WATER RESOURCES OF THE BELLE RIVER BASIN, SOUTHEASTERN MICHIGAN,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07C.
W69-07734

FLOODS AT AMESVILLE, OHIO,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07C.
W69-07735

FLOODS IN WILTON CENTER QUADRANGLE, NORTHEASTERN ILLINOIS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07C.
W69-07736

FLOODS ON LITTLE BUFFALO CREEK AT WEST JEFFERSON, NORTH CAROLINA,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07C.
W69-07737

FLOOD PLAIN INFORMATION ON TIDAL LANDS AND COHANSEY RIVER IN CUMBERLAND COUNTY, NEW JERSEY.
Corps of Engineers, Philadelphia, Pa.
For primary bibliographic entry see Field 04A.
W69-07739

FLOOD PLAIN INFORMATION - TIDAL LANDS AND MAURICE RIVER CUMBERLAND COUNTY, NEW JERSEY.
Corps of Engineers, Philadelphia, Pa.
For primary bibliographic entry see Field 04A.
W69-07740

FLOOD PLAIN INFORMATION-CHARLOTTE AND MECKLENBURG COUNTY-NORTH CAROLINA.
Corps of Engineers, Charleston, S. C.
For primary bibliographic entry see Field 04A.
W69-07741

CHANGES IN THE CHANNEL MORPHOLOGY OF TRINITY RIVER AND EIGHT TRIBUTARIES IN CALIFORNIA, 1961-65,
Geological Survey, Menlo Park, Calif.
John R. Ritter.
Geol Surv Open-file Rep, Aug 1, 1968. 60 p, 27 fig, 9 tab, 17 ref.

Descriptors: *Channel morphology, *Alluvial channels, *California, Banks, Streamflow, Sediment load, Beds, Channel erosion, Discharge (Water), Regime, Shape, Sands, Gravels.
Identifiers: *Trinity River (Calif).

Most of the changes from 1961 to 1965 in the channel morphology of a 40-mile reach of the Trinity River in California were caused by the devastating flood of Christmas week, 1964, and perhaps to a lesser extent by the regulation of flow from Lewiston and Trinity Dams. The magnitudes of the changes in the Channel were recorded by means of repeated surveys of cross sections of the river located near the mouths of 8 tributaries. The greatest changes occurred near the mouths of North Fork Trinity River and Canyon Creek which were the farthest downstream of the 8 tributaries. Banks were eroded laterally as much as 140 ft and as much as 11 ft of deposition occurred in some areas. As the bed of the Trinity River is composed mostly of cobbles and pebbles, the maximum size of bed material moved during the flood was at least cobble and probably boulder. Erosion of the bed occurred at almost every section. The maximum recorded erosion of the thalweg was 1.7 ft; the maximum aggradation, 4.7 ft. Except for 1 section, the pool and riffle pattern indicated by the cross sections remained the same for 1961-65. At eroded locations the bed material became coarser; at aggraded locations, finer. (Knapp-USGS)
W69-07747

TYPICAL FREQUENCY CURVES OF MEAN DAILY DISCHARGES OF WATER AND NATURAL REGULATED FLOW OF TADZHIKISTAN RIVERS (RUSSIAN),
Akademiya Nauk Tadzhikskoi SSR, Dushanbe.
A. G. Trestman.
Dokl Akad Nauk Tadzh SSR, Vol 11, No 10, pp 41-45, 1968. 5 p, 1 fig, 1 tab, 5 ref.

Descriptors: *Streamflow, *Frequency, *Re
lated flow, Discharge (Water), Hydrologic pro
ties, Gaging stations, Rivers, Runoff, Snowm
Water supply, Water sources, Glaciers, Precip
tion (Atmosphere), Rain.
Identifiers: *Tadzhikistan Rivers (Russia), R
flow frequency curves.

Frequencies of mean daily discharges of the Ta
hikistan Rivers were analyzed on the basis of d
recorded, on the average, during 14-year period
80 hydrological stations located on 62 rivers of
area. By subdividing the Tadzhikistan area int
sections on the basis of their general geograph
and climatic characteristics and taking into c
sideration the river--feeding type, i.e. snowm
glaciers, etc., the author developed a detailed ta
of mean daily discharge frequencies and of
coefficients of natural regulated flows. (Gabr
USGS)
W69-07748

FLOW DURATION OF OHIO STREAMS,
Geological Survey, Columbus, Ohio.
For primary bibliographic entry see Field 07C.
W69-07753

**FLOOD PLAIN INFORMATION OF CHARL
RIVER, MEDWAY, MASSACHUSETTS,**
Corps of Engineers, Waltham, Mass.
For primary bibliographic entry see Field 04A.
W69-07764

**FLOOD PLAIN INFORMATION-MANA
RIVER, PUERTO RICO,**
Corps of Engineers, Jacksonville, Fla.
For primary bibliographic entry see Field 04A.
W69-07765

**FLOOD PLAIN INFORMATION, COTTO
WOOD CREEK, GRAND PRAIRIE A
ARLINGTON, TEXAS.**
Corps of Engineers, Fort Worth, Tex.
For primary bibliographic entry see Field 04A.
W69-07929

**COMPUTER APPLICATIONS IN HYDROLO
IN KANSAS,**
Geological Survey, Lawrence, Kans.
For primary bibliographic entry see Field 07C.
W69-07930

**HYDROLOGIC DATA: 1967, VOLUME
SOUTHERN CALIFORNIA,**
California State Dept. of Water Resources, Sac
mento.
John L. Lewis.
Calif Dep Water Resources Bull No 130-67, J
1969. 259 p, 18 fig, 11 tab, 3 append.

Descriptors: *Data collections, *Water quali
*California, Surface waters, Groundwater, Was
water disposal, Stream gages, Sampling, Wat
wells, Groundwater basins.
Identifiers: Southern California water quality, 19
water year.

Surface water quality, groundwater quality, a
wastewater quantity and quality data for the 196
67 water year for Southern California are tab
lated. Locations of surface water sampling statio
groundwater basins, and waste discharges a
shown. (Knapp-USGS)
W69-07933

**APPLICATION OF AN ELECTRONIC ANALO
COMPUTER TO THE EVALUATION ON TH
EFFECTS OF URBANIZATION OF THE R
NOFF CHARACTERISTICS OF SMAL
WATERSHEDS,**
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 04C.
W69-07951

ECIALIZED ANALOG COMPUTERS FOR
'DROLOGICAL CALCULATIONS AND
RECASTS,
drometeorological Centre, Moscow (USSR).
r primary bibliographic entry see Field 07C.
9-07952

E SOLUTION OF DIRECT AND INVERSE
OBLEMS OF OUTLET WAVES SPREADING
ANALOG COMPUTERS,
nistry of Reclamation and Water Economy,
van (USSR). Water Problems and
drotechnics Research Inst.
primary bibliographic entry see Field 07C.
9-07953

E MAR ANALOG COMPUTER FOR
ODELLING HYDROLOGICAL SERIES BY
E MONTE CARLO METHOD,
primary bibliographic entry see Field 02A.
9-07954

TIMATION OF FLOODS WITH THE AID OF
ALOGUE COMPUTERS,
drometeorologicheskii Institut, Leningrad
SSR).
L. Sokolovsky, and I. A. Shiklomanov.
Ass Sci Hydrol, Pub No 80, Vol 1, Symp on Use
Analog and Digital Computers in Hydrol, Tuc-
, Ariz, Dec 1968, pp 87-94, 1968. 8 p, 2 fig, 8

scriptors: *Analog computers, *Flood forecast-
*Flood routing, Resistance networks, Analog
dels, Hydrographs, Hydrograph analysis, Rout-
Water management (Applied), River forecast-

ntifiers: *USSR.

thods of estimation of the peak discharge and
od hydrograph using analog computers are
cribed. The value of lag between peaks of rain-
and runoff and the coefficient of the shape of
od expressed as ratio between the duration of
and rise limbs of the hydrograph are used as
ncipal parameters. The time of travel may be
sidered either constant during flood (linear
del) or changing in accordance with the area,
pe and the shape of the basin, percentage of
est area, and other physiographic and
rphometric characteristics. (Knapp-USGS)
9-07955

ILIZATION OF THE ANALOG COMPUTER
R SIMULATING THE SALINITY FLOW
STEM OF THE UPPER COLORADO RIVER
SIN,
h Water Research Lab., Logan.
Leon Hyatt, J. Paul Riley, and Eugene K.
elsen.
np on Use of Analog and Digital Computers in
drol, Tucson, Ariz, Dec 1968, Int Ass Sci
drol, Pub No 80, Vol 1, pp 101-111, 1968. 11 p,
g.

scriptors: *Analog computers, *Streamflow,
ater quality, *Colorado River, *Utah, Saline
er, Model studies, Water management (Ap-
d), Hydrologic budget, Streamflow forecasting,
er forecasting, Economics.
ntifiers: Water quality variations, Salt load
vers), Upper Colorado River.

anges in the hydrologic equilibrium of a river
in resulting from resource development bring
ut changes in the quality pattern as well. It is
portant to be able to predict what the resulting
lity changes might be from any contemplated
elopment at any specified location within the
r system. An electronic analog computer was
d for simulating the water and salt flows of the
per Colorado River basin. To calculate the rela-
nship between salt flow and water flow, a
drologic model is based on historical water
dgeting utilizing almost all available data of
er flows, municipal and industrial uses, and the
demands from agriculture. Where data or records are not available the trial and error capabilities of the analog, one of the most vital assets of the analog because of the ease and quickness in producing a solution, were utilized to obtain the most reasonable estimate of the lacking variable. The salt flow is added to the water flow system utilizing historic measurements of salt concentration. The salt concentration is characterized by a volume flow of salt coupled with the volume flow of water. Because of the integration capability of the analog computer the solutions obtained are on a continuous basis. Such information might be used in allocating the cost of damages to the pollutor resulting from the increase of salinity. The economics of water pollution could thus be evaluated at any point in the Upper Colorado River basin. (Knapp-USGS)
W69-07957

DIGITAL COMPUTER SOLUTIONS FOR FLOOD HYDROGRAPH PREDICTION FROM RAINFALL DATA,
Technische Hochschule, Munich (West Germany).
Hydraulics Research Station Obernach.
For primary bibliographic entry see Field 02A.
W69-07958

DETERMINATION OF THE RUNOFF HYDROGRAPH ON A DETERMINISTIC BASIS USING A DIGITAL COMPUTER,
Technical Univ. of Budapest (Hungary).
For primary bibliographic entry see Field 02A.
W69-07959

FLOOD PLAIN INFORMATION, CHICKAHOMINY RIVER WEST OF BOTTOMS BRIDGE, HENRICO COUNTY, VIRGINIA.
Corps of Engineers, Norfolk, Va.
For primary bibliographic entry see Field 04A.
W69-07961

FLOOD PLAIN INFORMATION, NEW RIVER, CHANEY, MILL, AND BLUE CREEKS, JACKSONVILLE, NORTH CAROLINA.
Corps of Engineers, Wilmington, N. C.
For primary bibliographic entry see Field 04A.
W69-07962

FLOOD PLAIN INFORMATION OF MUD RIVER IN VICINITY OF MILTON, WEST VIRGINIA.
Corps of Engineers, Huntington, W. Va.
For primary bibliographic entry see Field 04A.
W69-07963

FLOOD PLAIN INFORMATION REPORT ON DELAWARE RIVER, BUCKS COUNTY, PENNSYLVANIA.
Corps of Engineers, Philadelphia, Pa.
For primary bibliographic entry see Field 04A.
W69-07975

HYDROLOGIC REGIONS IN BULGARIA (BULGARIAN),
Iv Marinov, and T. Panajotov.
Hidrologija i meteorologija, Vol 16, no 6, pp 41-51, 1967. 11 p, 4 fig, 4 ref.

Descriptors: *Hydrologic aspects, *Climatic zones, *River basins, Precipitation (Atmospheric), Runoff, Snowmelt, Surface-groundwater relationships, Low flow.
Identifiers: *Bulgaria, Hydrologic regions, Mesta River, Struma River, Black Sea.

Regularities in precipitation and runoff permit division of Bulgaria into two regions: one influenced by the European continental climate, and the other by the continental and Mediterranean climate. Almost all of north Bulgaria and the western half of south Bulgaria comprise the first region where about 65% of the runoff occurs in the Feb-June period. In the second region, comprising the eastern half of south Bulgaria, a narrow strip of the northern Black Sea coast and parts of the Struma and Mesta River valleys, 65% of the annual runoff is in the Nov-Mar period. Three kinds of inflow are described: snowmelt and rainfall, snow, and rainfall; phases of the runoff are an index also, as is subterranean feeding. The river basins can be put into three groups: those with stable runoff, moderately stable and unstable runoff. (Gabriel-USGS)
W69-07979

A PROBLEM ON THE EFFECT OF KARST ON THE HYDROLOGIC REGIME OF RIVERS,
A. M. Gavrilov.
Hydrol of Fractured Rocks Vol 2, Proc Dubrovnik Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74, pp 544-562, 1967. 19 p, 9 fig, 22 tab.

Descriptors: *Karst, *Hydrologic cycle, *Hydrologic properties, *River flow, *Rivers, Fissures (Geology), Runoff, Discharge, Basins, Permeability, Water storage, Hydraulic structures, Precipitation, Hydrograph analysis, Gaging stations, Streamflow, Analog models, Water resources.
Identifiers: *European USSR, Volga River, Orodezh basin, Belomorsko-Kuloiskoye plateau, Onega-Severnaya Dvina.

The karstic effects upon the runoff of small rivers within the northern and central zones of the European part of the USSR were investigated on the basis of some detailed field work and permanent stream gaging station data observed during several years. The study shows that the application of the analogy method for hydrologic designs and, in particular, the use of ordinary small-scale maps of runoff should be strictly limited to indisputable cases of proven natural similarity. Schematic maps should be drawn of summer and winter runoffs associated with the approximate evaluation of water resources. It is recommended also to establish a relationship between streamflow and the level of underground waters feeding the rivers. The article discusses karstic influence on surface water in the following areas: (1) runoff in the Oredezh river basin; (2) streamflow in the Belomorsk-Kuloysk plateau; (3) streamflow in the Onaga-Dvina area; and (4) streamflow in the middle Volga region. (Gabriel-USGS)
W69-07982

STAGES AND DISCHARGES OF THE MISSISSIPPI RIVER AND TRIBUTARIES IN THE ST. LOUIS DISTRICT, 1965.
Corps of Engineers, St. Louis, Mo.
For primary bibliographic entry see Field 04A.
W69-07988

THE INFLUENCE OF AQUATIC VEGETATION ON RIVER DISCHARGE,
State Inst. of Hydrology and Meteorology, Warsaw (Poland).
For primary bibliographic entry see Field 04A.
W69-07989

SPATIAL VARIATION OF FLOOD FREQUENCIES AS RELATED TO HYDRAULIC GEOMETRY,
Georgia Univ., Athens. Dept. of Geography.
Richard A. Stephenson.
Southeastern Geol, Vol 10, No 3, pp 165-174, July 1969. 10 p, 1 fig, 4 tab, 7 ref.

Descriptors: *Rainfall-runoff relationships, *Flood forecasting, *Runoff forecasting, *Channel morphology, Statistical methods, Floods, Streamflow, Regression analysis, Flood routing.
Identifiers: Hydraulic geometry, Flood frequencies.

Hydraulic geometry is, in essence, the description of channel characteristics and their relationship to streamflow. The relationships of flood frequencies

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to hydraulic parameters are describedc, in theory and in numerous studies. From standardized residuals from regression, a significant variation was found in sample basins in the southern Blue Ridge Mountains. Also, it was found that the relationship between flood frequencies and hydraulic parameters is rather weak. (Knapp-USGS)
W69-07991

CHANNEL CAPACITY AND THE ADJUSTMENT OF STREAMS TO HYDROLOGIC REGIME,
Liverpool Univ. (England). Dept. of Geography.
A. M. Harvey.
J Hydrol, Vol 8, No 1, pp 82-98, May 1969. 17 p, 7 fig, 1 tab, 21 ref.

Descriptors: *Streamflow, *Alluvial channels, *Channel morphology, *Stage-discharge relations, Flow characteristics, Duration curves, Depth-area-duration analysis.
Identifiers: Flood recurrence intervals, Flood frequency.

Previous work on the frequency of bankfull discharge on alluvial streams in a variety of environments suggests a recurrence interval for bankfull conditions of somewhere between 1 and 3 yr. In 3 streams in southern England chosen for study, seventy-one cross sections were surveyed in the field and their discharge capacities determined. Variations in the frequency of bankfull were found both between the streams and along each stream. Flood regime stream-segments appear to exhibit adjustment to the 1-2 yr flood but with less frequent flooding downstream. Baseflow streams appear to be adjusted to rarer floods and the Wallop Brook exhibits an increase in flood frequency downstream. Two factors are suggested to explain these differences; the frequency of competent discharges and the duration of floods of a given frequency. The channels are seen to represent a balance between erosion and deposition influenced by the magnitude, frequency and duration of high discharges, but those of the baseflow streams appear to be more susceptible to short term changes by aggradation in response to subtle environmental variations. (Knapp-USGS)
W69-08006

ULTRASONIC FLOWMETERS FOR MEASURING RIVER TURBULENCE,
Kyoto Univ. (Japan). Disasters Prevention Research Inst.
For primary bibliographic entry see Field 07B.
W69-08017

FLOW DIVIDERS FOR THE MIDDLE DURANCE (FRENCH),
B.V.S. Co. (France). Research Dept.
For primary bibliographic entry see Field 08C.
W69-08021

BASIC DATA FOR URBAN HYDROLOGY STUDY, DALLAS, TEXAS--1966,
Geological Survey, Austin, Tex.
Trigg Twitchell.
Geol Surv Open-file Rep, 1966. 203 p, 3 fig, 1 tab.

Descriptors: *Rainfall-runoff relationships, *Urbanization, *Data collections, *Texas, Streamflow, Runoff, Hydrographs, Rainfall, Surface waters, Hydrologic data, Mass curves, Depth-area, Duration analysis.
Identifiers: Dallas (Tex), Urban hydrology.

Basic hydrologic data compiled for the study of urban hydrology in Dallas, Texas include data from raingages, stream gages, and flood-profile partial-record stations. Hydrographs and mass curves are given for major storms at each station. (Knapp-USGS)
W69-08056

2F. Groundwater

THEORY OF INFILTRATION,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
For primary bibliographic entry see Field 02G.
W69-07727

GEOLOGY FOR LAND AND GROUND-WATER DEVELOPMENT IN WAYNE COUNTY, MICHIGAN,
Wayne State Univ., Detroit, Mich.
Andrew J. Mazola.
Mich State Geol Surv Rep Invest No 3, 1969. 25 p, 9 fig, 4 plate, 1 map, 1 chart, 41 ref.

Descriptors: *Geology, *Hydrogeology, *Groundwater, *Michigan, Permeability, Glacial drift, Aquifers, Sands, Clays, Groundwater movement.
Identifiers: Wayne County (Mich), Detroit.

The subsurface geology of Wayne County, Michigan is discussed in a report intended for use by planning agencies. Map show bedrock geology, bedrock topography, glacial drift thickness, and glacial geology. Because water becomes involved directly or indirectly with many projects, this report briefly describes the bedrock and glacial deposits that are present beneath the county and the occurrence of groundwater in such materials. A small scale bedrock map of the state and a Michigan Stratigraphic Nomenclature Chart are also included to show the relationship of the geology of Wayne County to the rest of the state. (Knapp-USGS)
W69-07728

CHEMICAL PROPERTIES OF GROUND WATER AND THEIR CORROSION AND ENCRUSTATION EFFECTS ON WELLS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02K.
W69-07729

GROUND-WATER RESOURCES OF THE WIND RIVER INDIAN RESERVATION, WYOMING,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 03B.
W69-07731

APPLICATION OF ANALOGUE COMPUTERS FOR PREDICTING THE GROUND WATER REGIME OF ARTESIAN BASINS UNDER CONDITIONS OF THEIR DEVELOPMENT,
All-Union Research Inst. of Water Supply, Drainage, Hydro-Engineering Works and Engineering Hydrogeology, Moscow (USSR).
I. I. Krashin, and D. I. Peresunjko.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Int Ass Sci Hydrol, Pub No 80, Vol 1, pp 59-66, 1968. 8 p, 4 fig, 2 ref.

Descriptors: *Analog models, *Water-level fluctuations, *Groundwater basins, Artesian wells, Aquifers, Resistance networks, Forecasting, Water management (Applied), Discharge (Water), Recharge, Pumping.
Identifiers: USSR, Moscow Basin (USSR).

The application of electrical network models for a long-term prediction of the dynamics of falling groundwater heads as a result of intensive development in the central part of the Moscow artesian basin is discussed. The optimum regime of water sampling, the prospective areas for additional water sampling and the most appropriate pattern distribution of new water supply wells were calculated. To take into account the natural hydrogeological conditions of a great territory, use may be made of an electronic analogue computer. The pattern of an electrical model of the studied gion of the basin has been improved by solving a ries of reverse problems under the stationary non-stationary conditions. The natural and ar cial factors, which determine the nature and rat groundwater declines in the period of observat in the basin, were reproduced. To solve the reve problems and make predictions, a single-laye and a multi-layered pattern were modeled. (Kna USGS)
W69-07746

FORECASTING THE RISE OF GROU WATERS IN THE AREA OF THE RIV VAKHSH FOURTH TERRACE (RUSSIAN),
Akademiya Nauk Tadzhikskoi SSR, Dushanbe. stitut Pochvovedeniia.
E. G. Vaksman.
Dokl Akad Nauk, Tadzh SSR, Vol 11, No 10, 57-60, 1968. 4 p, 1 fig, 3 ref.

Descriptors: *Forecasting, *Aquifers, *Grou water movement, *Mathematical studies, Sa soils, Geology, Gravels, Infiltration, Hydrogeolo Pressure, Water balance, Water lev Hydrogeologic properties.
Identifiers: Groundwater behavior forecasting.

The possibility of forecasting the groundwa levels under the hydrogeological conditions pres in the Kolkhozabad district was analytically vestigated by using an equation of water bala and a differential equation of the fourth order. calculating the constants of integration and s stituting them into the solution of the fourth or equation, an equation characterizing the level groundwaters of the fourth terrace was obtain The study shows that the equation characteriz the groundwater levels takes into consideratio large number (over ten) of natural and econo factors and gives a good approximation of grou water levels present at any given period. (Gabr USGS)
W69-07750

EXPLOITATION OF GROUNDWATER A HYDROLOGIC BALANCE OF THE CALCA OUS MASSIFS OF TUNISIA (FRENCH),
Gilbert Castany.
Hydrol of fractured rocks Vol 2, Proc Dubrov Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74, 518-525, 1967. 8 p, 11 tab.

Descriptors: *Exploitation, *Groundwater, *Wa balance, *Hydrologic properties, *Limeston Precipitation, Aquifers, Water sourc Evapotranspiration, Water balance, Water we Pumping, Runoff, Hydrogeology, Infiltration.
Identifiers: *Tunisia, Calcareous massifs.

The supply of groundwater in the calcareous m sifs of Tunisia was investigated on the basis of ea er geological and hydrologic studies conducted T. Tixeront and E. Berkaloff, and H. Zebidi. article gives an estimate of the water bala worked out by Tixeront and Berkaloff based on determination of rain intensity, extraction volum and water reserves from spring discharges. Ap cation of the more general method based on calculation of evapotranspiration, surface run and infiltration is also given. The general meth was used by Zebidi for the evaluation of wa balance of Bargou. (Gabriel-USGS)
W69-07766

GROUND WATER IN ONTONAGON COUN MICHIGAN,
Geological Survey, Lansing, Mich.
C. J. Doonan, and G. E. Hendrickson.
Mich State Geol Surv Water Invest Rep No 9, M 1969. 29 p, 5 fig, 1 plate, 4 ref.

Descriptors: *Water resources, *Groundwa *Michigan, Water wells, Hydrologic data, Data c lections, Water quality, Aquifers, Water lev Water yield.
Identifiers: Ontonagon County (Mich).

Most wells in Ontonagon County, Michigan obtain water from glacial lake beds or from bedrock. Deposits of glacial till and outwash also yield water to domestic wells in a few parts of the county. The lake beds supply enough water for domestic use to many wells, but more than half of the wells in the county are drilled into bedrock to obtain a satisfactory supply. Wells yielding large supplies of several hundred gallons per minute are unknown in this county. Water from most wells is hard to very hard, and many wells yield water that contains objectionable amounts of iron. Water from the deeper wells in bedrock, especially near Lake Superior, is generally too salty for domestic use. (Knapp-USGS)
W69-07926

HYDROLOGIC DATA: 1967, VOLUME 5: SOUTHERN CALIFORNIA,
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 02E.
W69-07933

ELECTROLYTIC TANK TYPE MODELS FOR PREDICTING THE POSITION OF THE GROUNDWATER TABLE AND THE LOSS OF RIVER DISCHARGES,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 02A.
W69-07949

ELECTRICAL-ANALOG ANALYSIS OF THE HYDROLOGIC SYSTEM IN TUCSON BASIN, ARIZONA, U.S.A.,
Geological Survey, Tucson, Ariz.
T. W. Anderson.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Int Ass Sci Hydrol, Pub No 80, Vol 1, pp 15-24, 1968. 10 p, 5 fig.

Descriptors: *Model studies, *Analog models, *Groundwater basins, *Arizona, Water levels, Water-level fluctuations, Pumping, Water wells, Aquifers, Forecasting, Water demand, Planning, Water yield, Recharge.
Identifiers: Tucson Basin (Ariz).

The water supply for the area in the Tucson basin, Arizona, is derived entirely from groundwater, and pumpage has caused water-level declines of as much as 60 ft. An electrical-analog model of the hydrologic system in the Tucson basin area was constructed to provide a hydrologic tool for determining the effects of possible groundwater management schemes. Periodic water-level data, pumpage, and transmissibility constants were compiled to allow the construction of the primary model. Preliminary analyses of the model showed where additional data or modifications in model design were needed. The final design, the most precise representation of the actual data was used to predict groundwater levels in 1985, assuming that pumpage is stabilized at the present rate and distribution. (Knapp-USGS)
W69-07950

NEW APPROACH SUGGESTED FOR DESIGN OF ELECTRICAL ANALOG COMPUTERS FOR GROUNDWATER FLOW STUDIES,
Tata Inst. of Fundamental Research, Bombay (India).
P. Kumaraswamy.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Int Ass Sci Hydrol, Pub No 80, Vol 1, pp 95-100, 1968. 6 p, 9 ref.

Descriptors: *Analog models, *Aquifers, *Groundwater movement, Pumping, Water wells, Water levels, Water level fluctuations, Water management (Applied).
Identifiers: India.

The usual electrical analog computer used for groundwater studies consists of an analog model simulating the aquifer by an array of discrete resistors and capacitors representing a scaled version of the hydraulic resistance and storage properties. Invariably it is economically impossible to gather sufficient field data to truly assess the aquifer characteristics and hence to build a true analog. To obviate the above difficulty, a new approach of design of the computing device is suggested. Only pumping rates and water levels and the history of their variations in space and time as well as the depths and locations of all wells are used. A liquid medium (continuous resistance in lieu of discrete resistors) should be selected and wells will be simulated by conducting rods of suitable dimensions and penetrations into the electrolyte. By utilizing suitable servos, all the observed potential changes and current changes in the analog will simulate synchronously the water level and flow changes in the aquifer. Such a computer will simulate the aquifer at every moment, as and when the excitation-response pairs are transduced into electrical quantities and telemetrically injected into the analog. (Knapp-USGS)
W69-07956

SIMULTANEOUS FLOW OF WATER AND HEAT UNDER PERIODIC HEAT FLUCTUATIONS,
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agricultural Research.
For primary bibliographic entry see Field 02G.
W69-07964

MINERAL WATERS OF THE BURGAS (BULGARIA) ARTESIAN BASIN AND THEIR HEALTH RESORT AND ECONOMIC SIGNIFICANCE (BULGARIAN),
K. Sterev, and T. Kehajov.
Nauc. tr. NII kurortologija i fizioterapija, Vol 9, pp 37-44, 1968. 8 p, 2 fig, 2 tab, 5 ref.

Descriptors: *Mineral water, *Artesian wells, *Aquifers, *Spring waters, Economics, Geology, Thermal water, Sedimentary rocks, Igneous rocks, Industrial waters, Carbon dioxide.
Identifiers: *Bulgaria, Mineralized springs, Health resorts.

The possibility of finding deep overheated waters in the Burgas anticlinorium was investigated by examining water-bearing complexes of Pre-Senonian formations. The study shows that these complexes, overlain by a thick volcano-sedimentary series, contain overheated waters carrying in some places a high content of carbon dioxide. It is estimated that the producing horizons of overheated waters would be reached at a depth of 1000 m or more. (Gabriel-USGS)
W69-07970

HARDNESS OF GROUND WATERS IN BULGARIA (BULGARIAN),
Toso M. Kehajov.
In Jubileen geologiceski sbornik (Anniversary geological collection), Sofia, Bulgavskaya Akademiya Nauk, pp 447-455, 1968. 10 p, 4 fig, 5 tab, 9 ref.

Descriptors: *Aquifers, *Hardness (Water), *Water chemistry, Chemical analysis, Calcium, Carbonates, Mountains, Manganese, Chlorides, Sulfates, Mapping.
Identifiers: *Bulgaria.

Mineral characteristics of Bulgarian groundwaters are examined using earlier publications and recent studies by the author. The average water mineralization ranges from 0.2 to 1.2 g/l. Low mineralized hydrocarbonate-calcium waters are associated with the high mountain areas and waters of higher mineral content are found in the plains and coastal areas. Groundwater in the plains and coastal areas is of the calcium-magnesium and sulphate-chloride type. A map is presented giving the distribution of groundwaters in Bulgaria based upon the following criteria: very soft (Ca and Mg less than 1.5 mg eq), soft (1.5-3.0 mg eq), medium hard (3.0-4.5 mg eq), fairly hard (4.5-6.0 mg eq), hard (6.0-9.0 mg eq), and very hard (greater than 9 mg eq). (Gabriel-USGS)
W69-07971

DETERMINATION OF HYDROGEOLOGICAL PARAMETERS BY PUMPING TESTS IN WATER TABLE AQUIFER (BULGARIAN),
Il. G. Jotov.
In Jubileen geologiceski sbornik, (Anniversary Geological Collection), Sofia, Bulgavskaya Akademiya Nauk, pp 457-465, 1968. 9 p, 2 fig, 2 tab, 6 ref.

Descriptors: *Hydrologic properties, *Aquifers, *Water table, *Pumping, Theis equation, Mathematical studies, Parametric hydrology, Wells, Hydraulics, Analytical techniques.
Identifiers: *Hydrogeological parameters, Pumping tests.

An analytical method is developed for determination of the formation characteristics in unconfined aquifers (water table conditions). The analysis is made on the basis of solving flow equations in which specific yield is variable in time (Boutlon's equation). Data are recorded at two observation wells and parameters are evaluated by using the Theis method. Comparison is made between drawdowns obtained at variable and at constant specific yields. It is concluded that the method used reduces considerably the duration of pumping tests. A numerical example is given to illustrate the method. (Gabriel-USGS)
W69-07972

CONFINED FRESH WATER AQUIFERS IN LIMESTONE EXPLOITED IN NORTH MEXICO WITH DEEP WELLS BELOW SEA LEVEL,
Office of Hydraulic Resources (Mexico).
Heinz Lesser Jones.
Hydrol of Fractured Rocks Vol 2, Proc Dubrovnik Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74, pp 526-539, 1967. 14 p, 9 fig.

Descriptors: *Groundwater, *Hydrologic properties, *Limestones, Water wells, Geologic control, Water yield, Artesian wells, Transmissivity, Drawdown, Sea level, Mesozoic era, Groundwater recharge, Storage capacity, Rainfall, Geomorphology, Pleistocene epoch, Geophysics, Electrical well logging.
Identifiers: *Mexico, Eastern Sierra Madre Range.

Fresh water aquifers in limestone formations of the Eastern Sierra Madre, Mexico, are described on the basis of geological, hydrological, and electrical well-logging data. The limestones are very persistent and pervious, of total thickness of about 1,000 m, and contain in some areas aquifers of considerable productivity. Several cities in northern Mexico obtain their water supply from the limestones. About 50 wells of depths varying from 200 to 1,400 m and elevations varying from 1 to 800 m below sea level have been developed by these cities. The confined limestone aquifers are under artesian pressure. Well yields of 40 to 240 liters per second and drawdown of 2 to 40 m have been recorded. Water levels vary from 20 to 80 m seasonally. Transmissibilities and storage capacities are extremely high. Recharge from the isolated rains that occur within the aquifer outcrops is nearly instantaneous. (Gabriel-USGS)
W69-07981

PROBLEMS OF STORAGE DAM CONSTRUCTION IN EASTERN HERZEGOVINA (FRENCH),
For primary bibliographic entry see Field 08A.
W69-07984

CARBONATE EQUILIBRIA AND RADIOCARBON DISTRIBUTION RELATED TO GROUND-

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WATER FLOW IN THE FLORIDAN LIMESTONE AQUIFER, USA,
Geological Survey, Washington, D. C.
Bruce B. Hanshaw, William Back, and Meyer Rubin.
Hydrol of Fractured Rocks Vol 2, Proc Dubrovnik Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74, pp 601-614, 1967. 14 p, 8 fig, 2 tab, 10 ref.

Descriptors: *Groundwater movement, *Aquifers, *Limestones, *Chemical reactions, *Florida, Equilibrium, Carbon, Dolomite, Radioactivity, Radioactive dating, Sulfates, Calcium carbonate, Water properties, Water quality, Groundwater recharge, Groundwater, Tertiary, Geology, Hydrogeology, Magnesium.

The application of geochemical principles to a reasonably well known hydrologic environment is applied for determining the solid phases which control the chemistry of water moving through an aquifer system. Major recharge to the Floridan aquifer, consisting of a series of limestones of Tertiary age and some dolomite, occurs in both high and low areas of the piezometric surface. Principal areas of recharge in the aquifer are marked by low total dissolved solids, low sulfate and magnesium content, and high C-14 concentrations (low apparent ages). Because C-14 concentration decreases in a systematic manner, apparent groundwater velocities may be reliably calculated. The article contains among others, the following topics: chemical character of the water: radiocarbon concentrations; and mineral equilibrium. (Gabriel-USGS)
W69-07985

UNCONFINED AQUIFERS AND THE CONCEPT OF THE SPECIFIC YIELD,
Agricultural Research Council, Cambridge (England). Unit of Soil Physics.
E. G. Youngs.
Bull Int Ass Sci Hydrol, Vol 14, No 2, pp 191-197, June 1969. 7 p, 2 fig, 9 ref.

Descriptors: *Specific yield, *Aquifers, Groundwater movement, Infiltration, Permeability, Drainage, Porosity, Specific retention, Water storage, Percolation.
Identifiers: Groundwater flow equations.

The concept of the specific yield as it is applied to unconfined aquifers is discussed, and it is shown that the value of the true specific yield is generally a function of both horizontal position and time. Because of the difficulties associated with the measurement of local fluxes and local water-table movements necessary to obtain values of the true specific yield, the average, the bulk and the virtual specific yields are defined, all of which are time dependent and the last 2 of which require the measurement of average fluxes over the catchment area. The non-constancy of the specific yield is illustrated in experimental results obtained with intermittent rainfall over a drainage installation where negative values were obtained, and reached infinite positive and negative values at maximum and minimum water-table heights. (Knapp-USGS)
W69-08000

TRANSIENT FLOWS IN AQUIFERS WITH FREE WATER SURFACES, TAKING INTO ACCOUNT THE UNSATURATED ZONE: CRITIQUE OF CLASSIC ANALOG MODELS (FRENCH),
Grenoble Univ. (France). Laboratoires de Mecanique des Fluides.
G. Vachaud, and J. L. Thony.
Bull Int Ass Sci Hydrol, Vol 14, No 2, pp 199-215, June 1969. 16 p, 5 fig, 1 tab, 22 ref.

Descriptors: *Groundwater movement, *Equations, *Mathematical models, Permeability, Aquifers, Saturated flow, Unsaturated flow, Drainage, Evaporation, Recharge, Hydraulic conductivity, Hydraulic models.
Identifiers: Boussinesq equation.

An attempt was made to consider as a whole the flow of water in both saturated and unsaturated zones. The position of the water table, when considering the hydrodynamics of free surface aquifers, must be controlled by the flow occurring in the unsaturated zone. A system of 2 differential equations, each one related to the saturated and unsaturated zone, is proposed for defining the position of the water table. This replaces the unique classical BOUSSINESQ equation, which is obtained by considering the free surface as the upper boundary of the flow domain. In view of experimental results obtained from the drainage of vertical soil columns, a critique of classical analog models is made. A two-dimensional soil hydraulic model is proposed for obtaining a complete description of the variation of water-content, water fluxes and pressure during unsteady conditions of drainage and recharge. Measurements of changes of water content and pressure may be obtained during unsteady conditions of drainage and recharge by a series of 3 Am-241 sources of gamma-rays and 20 tensiometers and pressure transducers connected to a data-logging system and computer. (Knapp-USGS)
W69-08001

GROUNDWATER STUDIES IN THE SABI VALLEY, RHODESIA, USING NATURAL TRITIUM MEASUREMENTS,
Agricultural Research Council of Central Africa. Hydrology Research Team.
P. Wurzel, and P. R. B. Ward.
J Hydrol, Vol 8, No 1, pp 48-58, May 1969. 11 p, 2 fig, 1 tab, 10 ref.

Descriptors: *Groundwater movement, *Tracers, *Tritium, Base flow, Laboratory tests, Electrolysis, Radio-chemical analysis, Surface-groundwater relationships.
Identifiers: *Sabi Valley (Rhodesia).

Environmental tritium was used as a groundwater tracer in the Sabi Valley Alluvial plain in Rhodesia, and flow data was obtained on a regional scale. It is shown that its groundwater movement is closely approximated by direct flow and the tritium content in boreholes is related to tritium input in 2 areas of recharge. The preliminary results indicate that the Sabi River is playing a greater part in the groundwater regime of the alluvial plain than originally anticipated. Velocity of movement of the groundwater is deduced as 2-5 ft/day. The low level tritium counting system used in the authors' laboratory is briefly described, and the limit and accuracy of measurement is discussed. (Knapp-USGS)
W69-08004

A STUDY OF THE SPECIFIC YIELD IN LAND-DRAINAGE SITUATIONS,
Agricultural Research Council, Cambridge (England). Unit of Soil Physics.
For primary bibliographic entry see Field 04A.
W69-08005

THE APPLICATION OF ENGINEERING GEOLOGY IN THE REGIONAL DEVELOPMENT OF NORTHERN AND CENTRAL IRAN,
Imperial Coll. of Science and Technology, London (England). Dept. of Geology.
For primary bibliographic entry see Field 4B.
W69-08009

EFFECT OF NEOTECTONICS ON THE FORMATION CONDITIONS OF GROUND WATERS OF THE EASTERN PART OF THE CHU BASIN (RUSSIAN),
Chu Hydrogeological Expedition.
Yu. P. Kopotilov.
Razved i Okhrana, No 3, pp 46-48, Mar 1969. 3 p, 1 fig.

Descriptors: *Hydrogeology, *Aquifers, *Structural geology, Boreholes, Mapping, Groundwater basins, Discharge (Water), Discharge measurement, Paleozoic era, Quaternary period, Water storage, Water loss, Water structure, Water level, Water circulation.
Identifiers: *Chu basin (Cent. Asia).

The effect of neotectonics on the groundwater fo mation was investigated on the basis of borehol geological, and hydrological data recorded by t Chu (Central Asia) hydrogeological expedition 1966-1967. The study shows that the Chu inte montane basin consists of gravel and boulder be of Quaternary period underlain by the Paleozo metamorphic rocks. The conditions for the acc mulations of groundwaters in the Paleozoic a Quaternary rocks are very dissimilar with specif discharges from boreholes in the Quaternary roc up to 50 lit/sec, whereas discharges from t Paleozoic formations do not exceed 5-10 lit/se The study also shows that the water of the C River, after leaving the Boom Canyon, partly inf trates the soft clastic formations. Hydrolog characteristics of the eastern part of the Chu bas are determined by the neotectonic Paleozoic bas ment block structure. (Gabriel-USGS)
W69-08016

HYDROGEOLOGIC DATA FROM CHEYENN DECATUR, RAWLINS, SHERIDAN, SHEMA AND THOMAS COUNTIES, KANSAS,
Kansas State Geological Survey, Lawrence; a Geological Survey, Lawrence, Kans.
For primary bibliographic entry see Field 07C.
W69-08018

THE MINERAL WATER SPRINGS AT EVIA (FRENCH),
Department of Sciences, Paris (France). Lab. Geology Dynamics.
B. Blavoux.
La Houille Blanche, Vol 24, No 1, pp 21-29, 196 9 p, 12 fig, 1 tab.

Descriptors: *Spring waters, *Water sourc *Mineral water, Hydrologic properties, Geolog mapping, Aquifers, Altitude, Hydrogeolog Precipitation (Atmospheric), Evapotranspiratio Discharge (Water), Runoff, Sedimentatio Glaciers, Water circulation, Water storage, Trit um, Sulfates, Iron, Magnesium, Calcium, Oxyge Water balance.
Identifiers: *France, Evian area.

This paper, a summary of a doctorate thes presented at the Faculty of Sciences, Pari describes the hydrogeological conditions in t Evian area, France. Objective of the work was determine the origin of the mineral springs a their characteristics and to evaluate the amount water stored in the Evian aquifer. Surface geolog cal surveys were made and deep boreholes we drilled into the Quaternary fluvio-glacial form tions in the Lower Chablaie area. Concurrent c matological and hydrochemical studies were ma of the entire catchment area and a groundwat balance was established. It is concluded that t mineral springs have their source in the Quaterna rocks of the Vinzier Plateau. The distribution dynamic and hydrochemical characteristics several places in the aquifer are describe (Gabriel-USGS)
W69-08019

MATHEMATICAL SIMULATION OF WATE MOVEMENT THROUGH UNSATURATE NONHOMOGENEOUS SOILS,
Harvard Univ., Cambridge, Mass. Dept. of Wat Resources.
For primary bibliographic entry see Field 02G.
W69-08026

GROUNDWATER AQUIFER PATTERNS AN VALLEY ALLUVIATION ALONG MOUNTA FORK CREEK, CRAWFORD COUNTY, A KANSAS,
H. F. Garner.
Arkansas Academy of Science Proceedings, V 20, 1966, pp 95-103. 9 p, 4 fig, 5 ref.

Descriptors: *Groundwater, *Aquifer.
Identifiers: *Alluviation, Run-off alluvial thickness, Channel-fill.

The study delineates several alluvium-aquifer relations for Boston Mountain drainage systems. Specifically with regard to Mountain Fork Creek, the bulk of the valley is too thinly alluviated to provide extensive alluvial groundwater along long reaches. Also, many of the thicker alluvial sections are composed of poorly sorted colluvium in the form of small valley-side alluvial fans. Only where these accumulations have been subject to valley-side runoff from springs and tributaries have been fine clastic fractions been flushed away and in some cases such gravels are a potential source of groundwater. It should be emphasized that channel fills of aquifer caliber are close to and essentially parallel to the main stream channel except directly downvalley from sharp bends in the channel or on the concave side of large bends where overflow has affected large portions of the valley flat. Also, in the latter areas alluvial thickness seems greatest, and water-well locations in such sites appear to have the greatest potential.
W69-08118

2G. Water in Soils

THEORY OF SEEPAGE FROM OPEN CHANNELS.
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab,
Herman Bouwer.
Advance in Hydroscience, Vol 5, pp 121-172, 1969. 52 p, 32 fig, 3 tab, 46 ref.

Descriptors: *Seepage, *Soil water movement, Soil physics, *Model studies, *Research and development, Infiltration, Open channels, Water table, Mathematical models, Analog models, Computer models, Measurement, Hydraulic conductivity, Permeability.
Identifiers: Open-channel seepage, Seepage prediction.

Prediction of seepage from open channels and the measurement of soil hydraulic properties are discussed in a review of current mathematical and field studies in soil water movement. Solutions are available for seepage rates for a great variety of channel, soil, and water table conditions. Most analyses are for steady-state systems, but some transient systems may be handled. Digital and analog computers permit calculation of many boundary conditions. Recent work in soil physics and soil-property measurement makes possible accurate determination of field parameters and realistic model-making. For main entry see W69-07723. (Knapp-USGS)
W69-07725

THEORY OF INFILTRATION,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
J. R. Philip.
Advance in Hydroscience, Vol 5, pp 215-296, 1969. 82 p, 20 fig, 1 tab, 133 ref.

Descriptors: *Infiltration, *Soil water movement, Groundwater movement, Soil physics, Percolation, Absorption, Mathematical studies, Model studies, Unsaturated flow, Saturated flow, Steady flow, Unsteady flow.
Identifiers: *Infiltration theory.

Recent work in the theory of infiltration is reviewed. The physical basis of the mathematical approach and the limits of its applicability are outlined. A general flow equation is developed, methods for its solution are described, and the physical significance of mathematical solutions is discussed. A bibliography of 133 papers is included. For main entry see W69-07723. (Knapp-USGS)
W69-07727

CLASSIFICATION OF SOILS WITH REFERENCE TO COMPACTION,
Swedish Geotechnical Inst., Stockholm; and Aktiebolaget Vibro-Verken, Solna (Sweden).
For primary bibliographic entry see Field 08D.
W69-07813

IN SITU MEASUREMENT OF THE FREE ENERGY OF SOIL MOISTURE BY SMALL HYGROMETERS (PART 1),
Kyoto Univ. (Japan). Disasters Prevention Research Inst.
For primary bibliographic entry see Field 07B.
W69-07932

SIMULTANEOUS FLOW OF WATER AND HEAT UNDER PERIODIC HEAT FLUCTUATIONS,
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agricultural Research.
A. Hados.
Soil Sci Soc Amer Proc, Vol 32, No 3, pp 297-301, May-June 1968. 5 p, 5 fig, 1 tab, 12 ref, append.

Descriptors: *Heat flow, *Unsaturated flow, *Soil-water movement, *Mathematical models, Mass transfer, Water temperature, Diffusion, Energy transfer, Soil physical properties.
Identifiers: Periodic heat fluctuations, Thermal gradients.

Theoretical predictions of thermally induced moisture transfer have been compared to measured quantities. Soil samples at different initial moisture contents were subjected to sinusoidal heat waves having an amplitude of 6C, and various periods of time. Temperatures were measured at various distances from the heat source, using copper-constantan thermo-couples and recording the emf output. The moisture distribution after the 1st, 2nd, 6th, and 16th cycle was determined gravimetrically. The measured net transfer quantities were found to be larger than the theoretically predicted values by factors ranging from 0.8 to 8.0. The discrepancy between predicted and measured values of net transfer may be attributed to the incompleteness of the theoretical models. (Knapp-USGS)
W69-07964

SELF-DIFFUSION OF TRITIATED WATER IN MONTMORILLONITE AND KAOLINITE CLAY,
Kentucky Univ., Lexington; and Arkansas Univ., Fayetteville.
R. E. Phillips, and D. A. Brown.
Soil Sci Soc Amer Proc, Vol 32, No 3, pp 302-306, May-June 1968. 5 p, 4 fig, 1 tab, 16 ref.

Descriptors: *Diffusion, *Clays, *Tritium, *Tracers, Tracking techniques, Soil water movement, Unsaturated flow, Mass transfer, Diffusivity, Radioisotopes.
Identifiers: Self-diffusion, Montmorillonite, Kaolinite.

The quick-freeze technique of measuring diffusion coefficients of ions in clays and soils was adapted to the measurement of self-diffusion coefficients of tritiated water in clays. The self-diffusion coefficients of tritiated water were approximately equal in the kaolinite and montmorillonite clays. The water contents, oven-dry weight basis, used for montmorillonite were 125.0, 118.5, 100.0, and 87.0%; the water contents used for kaolinite were 60.5, 55.0, 43.5, and 39.0%. The calculated average number of water layers on each mineral surface ranged from 3.5 to 5.5 for montmorillonite and from 17 to 26 for kaolinite. The self-diffusion coefficients increased in a linear manner as the average number of water layers present on each mineral surface increased; a slightly different rate of increase was obtained for each of the 2 clays. The lack of difference of the diffusion coefficients in the 2 clays could not be explained on the basis of charge density of the clays nor was a difference in viscosity a plausible explanation. A longer path length of the diffusing water molecules in the kaolinite and a smaller relative mobility of the diffusing water molecules in the montmorillonite is given as a possible explanation. (Knapp-USGS)
W69-07965

HYDRAULIC PROPERTIES OF A CLAY LOAM SOIL AND THE FIELD MEASUREMENT OF WATER UPTAKE BY ROOTS: 1. INTERPRETATION OF WATER CONTENT AND PRESSURE PROFILES,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
C. H. M. Van Bavel, G. B. Stirk, and K. J. Brust.
Soil Sci Soc Amer Proc, Vol 32, No 3, pp 310-316, May-June 1968. 7 p, 12 fig, 1 tab, 5 ref.

Descriptors: *Soil water movement, *Clay loam, *Irrigation water, *Root zone, Percolation, Unsaturated flow, Soil-water-plant relationships, Water storage, Field capacity, Hydraulic conductivity, Consumptive use, Moisture uptake.
Identifiers: Root extraction (Water).

The distribution of irrigation water in an Adelanto clay loam profile was studied in a field plot by simultaneous, periodic observations of the water content and hydraulic head profiles. Successive measurement series were made with the plot bare and covered, bare, and planted to a sorghum crop. From the first two, the in situ and dynamic relations of water content to water pressure and to conductivity were obtained. From the cropped field data, the root-extraction pattern was derived, using the established hydraulic properties of the profile. The data demonstrate the variability within depths and locations of water retention and conduction properties and the consequent problem of calculating fluxes. The mobile character of soil water is also evident, confirming the inadequacy of static concepts of soil water 'constants' for a profile. Calculated root-extraction rates agreed reasonably with independent lysimetric measurements of the water loss from the surface to the atmosphere. (Knapp-USGS)
W69-07966

HYDRAULIC PROPERTIES OF A CLAY LOAM SOIL AND THE FIELD MEASUREMENT OF WATER UPTAKE BY ROOTS: 2. THE WATER BALANCE OF THE ROOT ZONE,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
C. M. H. Van Bavel, K. J. Brust, and G. B. Stirk.
Soil Sci Soc Amer Proc, Vol 32, No 3, pp 317-321, May-June 1968. 5 p, 7 fig, 1 tab, 14 ref.

Descriptors: *Water balance, *Root zone, *Soil water movement, Lysimeters, Irrigation water, Clay loam, Percolation, Unsaturated flow, Soil-water-plant relationships, Water storage, Hydraulic conductivity, Hydraulic gradient, Consumptive use, Evapotranspiration, Moisture uptake.
Identifiers: Root extraction (Water).

Soil water depletion rates in a 115-cm and a 170-cm deep profile of Adelanto clay loam were compared with lysimetrically obtained consumptive use rates for periods of many days after measured water applications. When the soil was bare, the depletion rates were always higher than the rate of loss to the atmosphere, and the inferred flux at the 170-cm depth was as high as 2 mm/day 8 days after irrigation. When the test plot was planted to sorghum an initially strong downward flux at the 170-cm depth reversed itself after about 10 days and became as high as 4 mm/day, representing upward flow of water from wet soil into the root zone above. The data imply that indiscriminate use of soil water depletion rates as representing consumptive use rates can be highly misleading at any time in an irrigation cycle. Further analysis shows that rational and satisfactory correction of depletion data is not likely feasible, and, at any rate, unworkable for the condition of the experiment. (Knapp-USGS)
W69-07967

LIBRARY U. OF L. URBANA-CHAMPAIGN

COUPLING PHENOMENA AS A POSSIBLE CAUSE OF 'NON-DARCIAN' BEHAVIOUR OF WATER IN SOIL,
Agricultural Univ., Wageningen (Netherlands). Lab. of Soils and Fertilizers.
G. H. Bolt, and P. H. Groenevelt.
Bull Int Ass Sci Hydrol, Vol 14, No 2, pp 17-28, June 1969. 12 p, 4 fig, 2 tab, 15 ref.

Descriptors: *Soil water movement, *Groundwater movement, Flow, Porous media, Darcy's law, Hydraulic gradient, Osmotic pressure, Convection, Ion transport, Diffusion.
Identifiers: Non-Darcian flow, Flow mechanism coupling.

The 'non-Darcian' behavior of water in soils may be caused by the coupling that can occur between the different transport phenomena. It is predicted that a difference in osmotic pressure will arise when solutions flow through porous media, and that due to that difference the resulting flow is related in a non-linear fashion to the applied pressure difference. Several numerical examples are presented. (Knapp-USGS)
W69-07993

UNSATURATED POROUS MEDIA AND THE THEORY OF MIXTURES (FRENCH),
Grenoble Univ. (France). Laboratoires de Mecanique des Fluides.
P. Guelin.
Bull Int Ass Sci Hydrol, Vol 14, No 2, pp 29-47, June 1969. 19 p, 36 ref.

Descriptors: *Unsaturated flow, *Porous media, *Hysteresis, *Mathematical models, Soil water movement, Groundwater movement, Diffusion, Osmosis, Thermodynamics, Hydraulic gradient, Osmotic pressure.
Identifiers: Ficks law.

The behavior of unsaturated porous materials is described in terms of Fick's mixture theory. Hysteresis is included by use of the Volterra's integral form or by an approximative method using experimental results. Several mathematical models corresponding to physically significant situations are derived from the theory. (Knapp-USGS)
W69-07994

DISPERSION AND REACTION IN UNSATURATED SOILS APPLICATIONS TO TRACERS,
Grenoble Univ. (France). Laboratoires de Mecanique des Fluides.
D. E. Elrick.
Bull Int Ass Sci Hydrol, Vol 14, No 2, pp 49-60, June 1969. 12 p, 24 ref.

Descriptors: *Soil water movement, *Unsaturated flow, *Tracers, Dye releases, Radioisotopes, Stable isotopes, Salts, Tracking techniques, Diffusion, Adsorption, Dispersion, Ion transport, Reviews.
Identifiers: Soil water movement tracers.

The commonly used soil moisture and groundwater tracers include dyes such as fluorescein, pyramine and non-fluorescent dyes; anions such as chloride and nitrate; radioactive isotopes either as cation complexes or in anionic forms, and tagged water molecules. In several studies soil moisture movements were measured by isotope tagging. It is worth noting that this method can be employed to determine groundwater recharge. The soil moisture zone is probably the most difficult realm of the environment in which to obtain acceptable tracer behavior. For example, comparisons of tritium and chloride movement in neutral to basic soils from arid regions suggest that chloride ions move at an equal or slightly faster rate than tritium. It has been assumed that chloride ions are repelled from the negatively charged soil particles into the central region of the pores where the water velocity is greatest and that tritiated water exchanges with water adsorbed on the soil particles, thus retarding the tritium movement. Both laboratory and field experiments indicated considerable retardation of the chloride relative to the tritium movement. Thus, the performance of any tracer being considered for soil moisture studies should be tested in the specific soil under investigation. (Knapp-USGS)
W69-07995

CONSIDERATIONS ON THE INFLUENCE OF A GASEOUS ENTRAPMENT PHASE IN POROUS MEDIA (FRENCH),
Louvain Univ. (Belgium). Dept. of Scientific Agronomy.
L. W. De Backer.
Bull Int Ass Sci Hydrol, Vol 14, No 2, pp 61-66, June 1969. 6 p, 2 fig, 14 ref.

Descriptors: *Unsaturated flow, *Porous media, Transmissivity, Diffusion, Solubility, Diffusivity, Hydraulic conductivity, Hysteresis.
Identifiers: *Gas entrapment.

In porous media, entrapped gas is considered as an important factor reducing the transmissibility of fluid. Because entrapment mechanisms are poorly known and entrapped gas content is a function not only of water content but also of time due to the gas solubility, experimental results do not match satisfactorily with the diffusivity or continuum mechanics theories which do not take the entrapped gas phase into account. Measurements of entrapped gas content are presented together with the corresponding water content hysteresis isotherm. (Knapp-USGS)
W69-07996

WATER CONTENT MEASUREMENT WITH^{60} keV GAMMA RAY ATTENUATION,
Agricultural Univ., Wageningen (Netherlands); and Technical Univ. of Prague (Czechoslovakia).
For primary bibliographic entry see Field 07B.
W69-07997

SOME CONSIDERATIONS ON THE EMPLOYMENT OF TENSIOMETERS (FRENCH),
Toulouse Univ. (France). Institut de Mecanique des Fluides.
For primary bibliographic entry see Field 07B.
W69-07998

A MATHEMATICAL FUNCTION FOR DESCRIBING CAPILLARY PRESSURE-DESATURATION DATA,
Manitoba Univ., Winnipeg. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 07B.
W69-07999

TRANSIENT FLOWS IN AQUIFERS WITH FREE WATER SURFACES, TAKING INTO ACCOUNT THE UNSATURATED ZONE: CRITIQUE OF CLASSIC ANALOG MODELS (FRENCH),
Grenoble Univ. (France). Laboratoires de Mecanique des Fluides.
For primary bibliographic entry see Field 02F.
W69-08001

ILLUSTRATIONS OF SOIL MOISTURE VARIABILITY IN SELECTED AREAS AND PLOTS OF DIFFERENT SIZES,
R. C. Hills, and S. G. Reynolds.
J Hydrol, Vol 8, No 1, pp 27-47, May 1969. 21 p, 10 fig, 21 ref.

Descriptors: *Sampling, *Soil moisture, *Variability, *Statistical methods, Probability, Fluctuation, Heterogeneity, Homogeneity, Soil surveys, Soil-water-plant relationships.
Identifiers: Soil moisture sampling, Sampling error.

Soil moisture variability in the upper 5-8 cm of the soil is considered in two connected studies. One covers variability over large and small areas, based on taxonomic units; the other, sample sizes required to give accurate estimates of mean val The gravimetric method is used and various stat cal tests are applied to the data. Variabilit marked over large (6 sq km) and very small (2. m) areas. In the study, 2 groups emerge: smaller, less than 950 sq m; and the larger, sev drainage classes and a catchment area. Th require, with a standard error of 2.5 at the probability level, 4-19 and 44-80 samples resp tively. Samples of only a few 'individuals' shown to give misleading results and theref some soil survey techniques and the calibratio soil moisture measuring equipment are questio Changes in soil moisture variability through t must also be considered. (Knapp-USGS)
W69-08002

HYDRAULIC PROPERTIES OF A CLAY LO SOIL AND THE FIELD MEASUREMENT WATER UPTAKE BY ROOTS: 3. CO PARISON OF FIELD AND LABORATO DATA ON RETENTION AND OF MEASUR AND CALCULATED CONDUCTIVITIES,
Agricultural Research Service, Phoenix, A Water Conservation Lab.
K. J. Brust, C. M. H. Van Bavel, and G. B. Stirk.
Soil Sci Soc Amer Proc, Vol 32, No 3, pp 322-3 May-June 1968. 5 p, 4 fig, 2 tab, 14 ref.

Descriptors: *Water storage, *Soil water, * water movement, *Hydraulic conductivity, * tention, Osmotic pressure, Moisture str Moisture tension, Field capacity, Moisture uptak Identifiers: Root extraction (Water).

Soil water characteristics obtained on soil core the laboratory at air pressures less than 1 agreed substantially with pressure-water cont relations determined in the field. Thus, in field dies of soil hydraulics, measurement of either wa content or pressure potential may suffice. W the laboratory data were supplemented with a d ble-tube measurement of the saturated conduct ty, the relation between water content and cond tivity was calculated using 2 methods. Of these, one due to Millington and Quirk gave less accu agreement with actual field measurements than the method proposed by Laliberte, Corey Brooks. The latter method, when based on dou tube measurements in the field and pressure c or similar measurements on cores in the laborat appears useful. Retention values measured with pressure membrane method on disturbed soil s ples were out of line with both field and c results, even when the disturbing treatments w minimized. (Knapp-USGS)
W69-08025

MATHEMATICAL SIMULATION OF WAT MOVEMENT THROUGH UNSATURAT NONHOMOGENEOUS SOILS,
Harvard Univ., Cambridge, Mass. Dept. of W Resources.
Flora Chu Wang, and V. Lakshminarayana.
Soil Sci Soc Amer Proc, Vol 32, No 3, pp 329-3 May-June 1968. 6 p, 6 fig, 1 tab, 16 ref.

Descriptors: *Unsaturated flow, *Soil water mo ment, *Mathematical models, Digital comput Synthetic hydrology, Diffusion, Hydraulic cond tivity, Capillary action.
Identifiers: Nonlinear diffusion equation.

The general states of flow of water through uns rated nonhomogeneous soils have been simula by the nonlinear diffusion equation. A numer technique is developed and programmed for IBM 7094 to solve the explicit-implicit differe scheme analog of the nonlinear partial differen equation of parabolic-type. The data utilized in study for the simulated soil profile are obtai from the experimental work of Nielsen et. (1964) for vertical drainage and infiltration. C puted cumulative loss and average rate are reasonable agreement with their field meas ments. The results indicate that the average rat drying and wetting are controlled largely by

ysical properties of the soil and their correspond-
g boundary conditions. (Knapp-USGS)
69-08026

H. Lakes

HE EFFECT OF PUMPED-STORAGE RESER-OIR OPERATION ON BIOLOGICAL RODUCTIVITY AND WATER QUALITY,
rginia Commonwealth Univ., Richmond; and
rginia Polytechnic Inst., Blacksburg.
r primary bibliographic entry see Field 05C.
69-07711

ICROBIOLOGICAL RESEARCH OF THE LUBOKOYE LAKE NEAR THE MOLODEZH-AYA STATION (RUSSIAN),
rkticheskii i Antarkticheskii Nauchno-Iss-dovatelskii Institut, Leningrad (USSR); Lenin-ad Higher School of Marine Engineering SSR); and Moscow State Univ. (USSR).
E. Kriss, M. V. Aleksandrov, A. M. Kozlovskiy, V. Ledeneva, and O. N. Leflat.
formatzionnyy Byulleten' 70, Sovetskoy Antark-heskoy Ekspeditsii, pp 44-48, 1968. 5 p, 2 tab, 7 f.

escriptors: *Lakes, *Microbiology, *Antarctic, e, Temperature, Oxygen, Bacteria, Salinity, ater levels, Sea level, Ions, Freezing, Sodium, emical analysis, Chlorine, Iron, Calcium, Mag-sium, Sulfur bacteria.
entifiers: *Lake Glubokoye, Antarctic crobiological study.

icrobiological and chemical characteristics of the ubokoye Lake located in the vicinity of the olodezhnaya Antarctic station were investigated the basis of the author's field work and earlier blications. The study shows that the lake of 00m x 500m dimension and of 36m maximum pth contains carbonate, bicarbonate, Cl, sulfate, g, Na, K, and Fe ions and micrococcus, hromobacter, and mycobacteria. In general the ke can be considered as belonging to the ultra-esh water type containing not more than 40 mgr/l mineralized matter. (Gabriel-USGS)
69-07752

RINCIPAL LAKES OF THE UNITED STATES,
ological Survey, Washington, D. C.
r primary bibliographic entry see Field 07C.
69-07770

ECHANICAL HARVESTING OF LAKE EEDS APPEARS PROMISING FOR HALTING GING PROCESS,
sconsin Univ., Madison. University-Industry search Program.
rald D. Seinwill.
R/Res Newsletter, Vol 3, No 3, Wisconsin Univ, adison, pp 16-17, August 1968. 3 fig, disc.

escriptors: *Aquatic weed control, Aquatic nts, Eutrophication, Wisconsin.
entifiers: *Mechanical harvesting, Aquatic plant stribution, Compositional index, Harvesting quency, Myriophyllum exalbescens, Lake Men-ta, Wisconsin.

echanical harvesting techniques are used as a ntrol method of increased plant growth in lakes, sulting from overenrichment. To provide in-eased information concerning the types of plants volved and effects of harvesting, the Wisconsin ater Resources Center sponsored a study by iversity of Wisconsin personnel. The first phase entified and mapped the plant communities in ke Mendota's University Bay. Species distribu-n was attributed to bottom soil texture and water pth. A compositional index was calculated by cording species composition of each community terms of percent frequency and relative frequen-of each species. Index ranged from 100 in low trient to 400 in high nutrient lakes. Composi-tional replacement (changes in species and relative importance of each) has taken place since 1922 studies. Compositional index has increased from 294 to 381, with predominant nuisance species presently being Myriophyllum exalbescens. The second phase, determining effects of harvesing, utilized uncut control sections and harvesting sections at various depths and bottom types. Harvesting is concluded to be a successful control measure by reducing regrowth and density, since all cut stems do not resprout immediately. One caution is the necessity of future sampling to monitor changes in species composition as other plants appear to fill the void. (Ketelle-Wisc)
W69-07815

THE EXCHANGE OF DISSOLVED SUBSTANCES BETWEEN MUD AND WATER IN LAKES,
Freshwater Biological Association, Ambleside (England).
Clifford H. Mortimer.
J Ecol, Vol 30, pp 147-201, 1942. 46 fig, 5 tab, 77 ref.

Descriptors: *Mud-water interfaces, *Lakes, Eutrophication, Oligotrophy, Sediments, Reduction (Chemical), Mud, Nutrients, Oxygenation, Oxidation-reduction potential, Conductivity, Circulation, Hypolimnion, Water chemistry, Cycling nutrients.
Identifiers: *Dissolved solutes, *Mud-water exchange, Jenkin sampler, Windermere, Esthwaite Water, Redox, Chemical stratification, Oxygen absorption rate, Eddy diffusion.

Seasonal variation in stratification of temperature, oxygen, alkalinity, pH, ammonium ion, nitrate ion, nitrite ion, silicon, phosphorus, ferric iron, ferrous iron, total iron, and sulfide ion, were illustrated in a series of depth-time diagrams for Esthwaite Water and Windermere lakes. Concurrently, the study of the distribution of redox potential, pH, and conductivity were determined with depth of the undisturbed cores of mud and water above the mud surface. Investigation of seasonal changes in a central water column and underlying mud in five English lakes disclosed relationships between the winter oxygen concentration above the mud surface, mean winter thickness of surface-oxidized mud layer, winter reducing intensity of mud, winter conductivity in mud, organic content of mud, and mean summer oxygen depletion rate in hypolimnion, expressed per unit area of mud surface. Reduction of the mud surface and the associated increase in supply of solutes to the water may be expected to augment plankton production. Examples are quoted. A description of the Jenkin surface mud sampler and the arrangement of redox and conductivity electrodes are given. (Bortleson-Wisc)
W69-07827

ECOLOGICAL HISTORY OF THE ENGLISH LAKE DISTRICT,
W. H. Pearsall, and W. Pennington.
Journal of Ecology, Vol 34, No 1, pp 137-148, Feb 1947. 2 fig, 1 tab, 8 ref.

Descriptors: *Paleolimnology, *Ecology, *History, *Erosion, *Lakes, *Sedimentation, *Eutrophication, Cores, Pollen, Organic matter, Sediments.
Identifiers: *English Lake District, Windermere, Archaeology, Paleoecological studies, Historical lake ecology, Watershed erosion.

The paper contains a summary of the archaeological background of the English Lake District and attempts to correlate the historical record with depth profile patterns of pollen and organic matter in sediment cores of Windermere. Evidence from the pollen and chemical analyses suggest that Windermere drainage system passed through the following stages: (1) a late glacial and immediate post-glacial phase of rapid erosion and stabilization by vegetation (pine-birch forest), (2) a steady state of alder woods and oak forest, (3) a phase of primary (upland) occupation by man and incipient pine forest degeneration (1500 BC to AD 900), (4) a period of secondary (valley) occupation by Norse, increased grazing and accelerated degeneration (900-1300 AD) accompanied by draining alder swamps, (5) period of economic exploitation for wool and timber (c 1300-1750 AD) with extreme woodland and soil degeneration, and (6) romantic period of replanting and amenity exploitation (1750-1940 AD). (Bortleson-Wisc)
W69-07828

SAMPLER FOR STUDIES OF THIN HORIZONTAL LAYERS,
Washington Univ., St. Louis, Mo. Dept. of Botany.
For primary bibliographic entry see Field 07B.
W69-07829

LIMNOLOGICAL CONDITIONS AND GROWTH OF TROUT IN THREE LAKES NEAR ROTORUA,
Marine Dept., Rotorua (New Zealand).
For primary bibliographic entry see Field 05C.
W69-07831

A TRACER EXPERIMENT WITH I-131 IN AN OLIGOTROPHIC LAKE,
Helsinki Univ. (Finland). Dept. of Radiochemistry.
For primary bibliographic entry see Field 05C.
W69-07859

THE SUBMERGED AQUATICS OF UNIVERSITY BAY: A STUDY IN EUTROPHICATION,
Wisconsin Univ., Madison. Dept. of Botany.
For primary bibliographic entry see Field 05C.
W69-07866

SOME LIME-INDUCED CHANGES IN LAKE METABOLISM,
Wisconsin Univ., Madison. Lab. of Limnology.
For primary bibliographic entry see Field 05C.
W69-07868

LAKE LYNGBY SO: LIMNOLOGICAL STUDIES ON A CULTURALLY INFLUENCED LAKE,
Copenhagen Univ., Hillerod (Denmark). Freshwater-biological Lab.
For primary bibliographic entry see Field 05C.
W69-07870

RECENT SEDIMENTATION CONDITIONS IN THE ILE SAINT PAUL LAGOON,
Akademiya Nauk SSSR. Institut Okeanologii.
Yu A. Bogdanov, V. I. Kuksa, F. A. Pasternak, and Ye A. Romankevich.
Engl edition of Akad Nauk, SSSR, transl by Amer Geophys Union, Wash, DC. Oceanology, Acad Sci of USSR, Vol 7, No 4, pp 494-500, 1967. 7 p, 5 fig, 1 tab.

Descriptors: *Lagoons, *Sedimentation, *Sediment distribution, Volcanoes, Hydrologic properties, Salinity, Water temperature, Velocity, Diatoms, Plankton, Suspension, Carbon, Organic compounds, Crustaceans, Detritus, Plants, Biomass, Aquatic life, Pollutants, Hydrogen sulfide, Benthic fauna.
Identifiers: *Ile Saint Paul lagoon sedimentation, Lagoon sedimentation process.

This article describes the results of the hydrological, geological, biological, and topographical study of the lagoon conducted by the personnel of the R. V. Vityaz during its 36th voyage. The study shows that the hydrodynamic features of the water have a favorable effect on the development of plankton. Diatom content in the suspended matter varies from 1,650 to 17,230 cells per liter, with the maximum number of diatoms found in the surface-water layer near the western shore. Vertically, the amount of organic matter in the suspended matter

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decreases rapidly, and less than 5% of the organic matter recorded at the surface is retained at the bottom. The extreme paucity of the benthic population in the deeper parts of the lagoon may be explained by the accumulation there of vast masses of rotting macrophytes. The characteristics of bottom sediments of the lagoon at several stations are analyzed and given graphically. (Gabriel-USGS)
W69-07978

LAKES IN THE CROATIAN LIMESTONE REGION,
Milivoj Petrik.
Hydrol of Fractured Rocks Vol 2, Proc Dubrovnik Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74, pp 565-589, 1967. 25 p, 11 fig, 23 tab, 37 ref.

Descriptors: *Lakes, *Lake morphology, *Limestones, *Water analysis, Hydrologic properties, Thermal stratification, Fractures (Geology), Geochemistry, Geomorphology, Carbonates, Magnesium, Carbon, Oxygen, Chloride, Carbon dioxide, Water structure, Springs.
Identifiers: *Yugoslavia, Croatia, Dalmatia, Islands of Cres and Krk.

This article describes the natural accumulation of water in the limestone region of Croatia, Yugoslavia and contains the analysis of hydrologic, geological, and geochemical conditions present in the several lakes of Dalmatia and of the Krk and Cres islands. The study shows that (1) the lakes of the region are characterized by a relatively low productivity; (2) the water is of the hydrocarbonate type with a mineral content characteristic of spring waters of the lake region; (3) sufficiently deep lakes (about 15 m) show clear thermal stratification; (4) the genesis of water accumulation is of variable character; and (5) development and maintenance of a lake depends upon several factors, the main ones of which are the meteorological conditions and the transmission capacity of subterranean channels. (Gabriel-USGS)
W69-07983

HYDROLOGIC ANALYSIS FOR LAKE ONTARIO: STOCHASTIC ASPECTS OF EVAPORATION.
Cornell Univ., Ithaca. School of Civil Engineering.
For primary bibliographic entry see Field 02D.
W69-08116

A CONTINUED PRE- AND POSTIMPOUNDMENT SURVEY OF THE HELMINTH AND CRUSTACEAN PARASITES OF MICROPTERUS DOLOMIEUI LACAPEDE, M. PUNCTULATUS (RAFINESOUE) AND M. SALMOIDES (LACEPEDE) (PERCIFORMES) OF BEAVER RESERVOIR IN NORTHWESTERN ARKANSAS,
Arkansas Univ., Fayetteville. Dept. of Zoology.
Wilbur B. Owen.
M.S. Thesis, University of Arkansas, Fayetteville, Arkansas 1969. 57 p, 4 tab, 3 fig, ref, 1 appendix. OWRR Project A-009-ARK.

Descriptors: *Parasites, *Impoundment, *Life cycle, *Physico-chemical fluctuations, Water quality, Intermediate hosts.

The intent of this research was continued pre- and postimpoundment survey to determine the species, number, and extent of parasite infections of Micropterus dolomieui, M. punctulatus, and M. salmoides in Beaver Reservoir in Northwestern Arkansas. A comparison of the fluctuations of parasitism in the three hosts from pre-impoundment through postimpoundment was made. Fluctuations of parasites were compared for three years following the impoundment of the White River watershed. A further objective of this study was to correlate fluctuations in the physicochemical water qualities of the reservoir with the qualitative and quantitative fluctuations of parasitism of the three hosts. Based on the data of this study it is concluded that the explanations of the fluctuations of the parasites following impoundment of the White River depend on the nature of the life cycles of the parasites. The data indicate that in order to draw significant conclusions concerning the correlation of physico-chemical water quality fluctuations, at least 4 to 5 years postimpoundment monitoring of water qualities is necessary.
W69-08121

2I. Water in Plants

HYDRAULIC PROPERTIES OF A CLAY LOAM SOIL AND THE FIELD MEASUREMENT OF WATER UPTAKE BY ROOTS: 1. INTERPRETATION OF WATER CONTENT AND PRESSURE PROFILES,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02G.
W69-07966

HYDRAULIC PROPERTIES OF A CLAY LOAM SOIL AND THE FIELD MEASUREMENT OF WATER UPTAKE BY ROOTS: 2. THE WATER BALANCE OF THE ROOT ZONE,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02G.
W69-07967

WATER DISPOSITION IN A STREAM CHANNEL WITH RIPARIAN VEGETATION,
Arizona Agricultural Experiment Station, Tucson; Agricultural Research Service, Tucson, Ariz. Southwest Watershed Research Center; and Arizona Univ., Tucson. Dept. of Soil Physics.
For primary bibliographic entry see Field 03B.
W69-07976

HYDRAULIC PROPERTIES OF A CLAY LOAM SOIL AND THE FIELD MEASUREMENT OF WATER UPTAKE BY ROOTS: 3. COMPARISON OF FIELD AND LABORATORY DATA ON RETENTION AND OF MEASURED AND CALCULATED CONDUCTIVITIES,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02G.
W69-08025

2J. Erosion and Sedimentation

FORMATION OF FLOOD PLAIN LANDS,
Army Engineer District, New Orleans, La.
For primary bibliographic entry see Field 04A.
W69-07707

TREND-SURFACE ANALYSIS OF THE BASIN AND RANGE PROVINCE, AND SOME GEOMORPHIC IMPLICATIONS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 04A.
W69-07730

CHANGES IN THE CHANNEL MORPHOLOGY OF TRINITY RIVER AND EIGHT TRIBUTARIES IN CALIFORNIA, 1961-65,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02E.
W69-07747

SPRING BOTTOM SEDIMENTS AS INDICATORS OF HIDDEN MERCURY MINERALIZATION (RUSSIAN),
Akademiya Nauk Tadzhikskoi SSR, Dushanbe. Inst. of Geology.
T. N. Nasimov, and Kh. M. Yusupov.
Dokl Akad Nauk Tadzh SSR, Vol 11, No 10, pp 54-56, 1968. 3 p, 1 fig, 1 tab, 3 ref.

Descriptors: *Springs, *Sediments, *Indica
*Mining engineering, Paleozoic era, Geol
Geomorphology, Geochemistry, Explora
Trace elements, Spectroscopy, Copper, I
radioisotopes, Zinc radioisotopes.
Identifiers: Spring sediment trace elements.

Spring bottom sediments were analyzed in carr
out the prospecting for mineral deposits in
vicinity of the Kavnok mercury occurrence.
prospecting consisted of the analysis for trace
ments (copper, mercury, zinc, and antimony)
all the occurrences of surface and undergro
waters in the area. The study shows that the an
sis of spring bottom sediments is a valuable a
tion to the application of hydrochemical meth
in prospecting for mercury and delineation of
bearing areas. (Gabriel-USGS)
W69-07749

**DOWNSTREAM CHANGES IN SEDIM
TOLOGICAL PARAMETERS ILLUSTRAT
BY PARTICLE DISTRIBUTION FROM
BREACHED ROCKFILL DAM,**
Geological Survey, Sacramento, Calif.
Kevin M. Scott.
Comm of Surface Waters, Proc Gen Assembl
Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub
75, pp 309-318, 1967. 10 p, 4 fig, 12 ref.

Descriptors: *Sediment transport, *Flo
*Historic flood, *California, *Particle size, D
failure, Erosion, Sedimentation, Discha
(Water), Tracers, Channels, Deposition (S
ments), Tractive forces.
Identifiers: Rubicon River (Calif).

A flood surge at least the equal of any p
Pleistocene discharge was released by failure
rockfill dam in the glacial canyon of the Rubi
River, California. The diorite rockfill in the
embankment acted as a point source of bouk
that could be traced downstream. Particle rou
ness changes were rapid, transition from angula
subangular occurred almost immediately after
itiation of movement, and change from subroun
to rounded took place approximately 1.5
downstream. Over 90% of the size reduc
downstream is due to progressive sorting. M
ment of the rockfill continued to a point 1.6
downstream. Sorting of these deposits increase
regularly downstream. Macroturbulent trans
resulted in the accretion of 5 feet of coarse mate
on a terrace level 28 ft above thalweg at a p
stage of 45 ft. Terrace-like berms formed
backwater areas and flow or wave fronts up to
high formed lobate scarps transverse to the ch
nel. Great lateral supply of coarse material to
channel was caused by the surge but only shor
crements of longitudinal transport occurred.
napp-USGS)
W69-07754

**FLUVIATILE MORPHOGENESIS OF ROU
NESS: THE HACKING RIVER, NEW SOU
WALES, AUSTRALIA,**
Makerere Univ. Coll., Kampala (Uganda). Dep
Geography.
Joseph P. B. M. Ouma.
Comm of Surface Waters, Proc Gen Assembl
Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub
75, pp 319-344, 1967. 26 p, 16 fig, 2 tab, 14 ref.

Descriptors: *Sediment transport, *Particle sh
*Particle size, *Abrasion, Channel flow, Riv
Statistical methods, Correlation analysis, Sa
Gravels, Alluvial channels, Alluvium.
Identifiers: *New South Wales (Austra
*Hacking River (Australia).

An intensive lithological, mechanical
morphological investigation into the sediment
the Hacking River, New South Wales, Australi
summarized. Particle roundness increases
calibre decreases, but in sub-granule grades rou
ness declines as size decreases. Unweighted m
roundness does not approach 1.0 asymptotic

wnstream, but first increases to a maximum, ience it declines downstream. Roundness anges at a medium rate in above-cobble grades, stest in cobble-granule range, and slowest in the b-granule grades. Mean roundness evolves wnstream faster than calibre decreases, and libre declines faster than mean sphericity olves. Roundness in the Hacking does not change confluences, because of small tributaries and trographic uniformity of the catchment. While undness dispersion and roundness skewness olve downstream irregularly in the Hacking, in ig sandy rivers roundness decreases downstream; weighted mean roundness is attained, and roundss approaches+1.0 asymptotically downstream. napp-USGS)
69-07755

ARIATION OF THE CHARACTERISTICS OF ELTAIC AND STREAM BED DEPOSITS IN ABORATORY STUDIES,
olorado State Univ., Fort Collins. Dept of Civil gineering; and Agricultural Research Service, ltsville, Md. Soil and Water Conservation search Div.
A. Reid, R. H. Brooks, and D. B. Simons.
mm of Surface Waters, Proc Gen Assembly of rn (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No , pp 345-354, 1967. 10 p, 6 fig, 1 tab, 5 ref.

scriptors: *Sedimentation, *Deltas, *Hydraulic odels, Model studies, Sediment transport, Reserir silting, Sedimentary structures, Sediment disbution, Sedimentology, Stratification.
entifiers: Delta sedimentation model.

e major processes that influence deltaic sedient distribution were studied in a laboratory me and stilling basin. The quantity and size of diment, the discharge of water, and the still water vel were held constant. The flume was 30.5 m ng, 7.32 m wide, and 0.61 in deep. Standard viation, skewness, and kurtosis of the data are mmarized graphically. As the height of the delta creased, standard deviation of the grain size inased because length of foresets diminished, lesning the length of path available for sorting. ere was no apparent increase in kurtosis and ewness with mean grain size. There was a cyclic ange in particle size alone, cross sections during position. Particle size increased down the esets. The relation of flow parameters to size disbution may be used to predict reservoir sedimenion or to calculate past flows from preserved dimentary sequences. (Knapp-USGS)
69-07756

ARIATIONS OF SEDIMENT TRANSPORT IN HE WASHITA RIVER,
gricultural Research Service, Chickasha, Okla. il and Water Conservation Research Div.
ul B. Allen, and Norman H. Welch.
mm of Surface Waters, Proc Gen Assembly of rn (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No , pp 355-366, 1967. 12 p, 5 fig, 2 tab, 8 ref.

scriptors: *Sediment transport, *Sediment yield, luvial channels, Suspended load, Sediment scharge, Channel morphology, Sediment load.
entifiers: Washita River (Okla), Sediment load timation.

udies of sedimentation and stream velocity on the ashita River, Oklahoma show that transport is arkedly different in bedrock and straight, curved, de, and narrow sand channels. Measured sedient discharges are compared with discharges calated by the Brooks, Einstein, and Colby ethods and the results are tabulated. The Brooks ocedure is believed to be fairly accurate in a samed wide channel. The Colby method compared ell, but the Einstein method estimated too low a lue. (Knapp-USGS)
69-07757

REGIONAL DIFFERENTIATIONS OF THE SUSPENDED SEDIMENT TRANSPORT IN THURINGIA AND THEIR RELATION TO SOIL EROSION,
Deutsche Akademie der Landwirtschaftswissenschaften zu Berlin (East Germany).
L. Bauer, and W. Tille.
Comm of Surface Waters, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 75, pp 367-377, 1967. 11 p, 4 tab, 21 ref.

Descriptors: *Sediment transport, *Suspended load, *Erosion, *Provenance, Sediment yield, Sediment discharge, Silts, Sands, Discharge (Water), Streamflow, Runoff.
Identifiers: *Thuringia (Germany), Unstrut River.

During the hydrologic years 1961 and 1962, 13 sampling stations within the watershed of the river Unstrut, Germany, carried out systematic measurements of the suspended sediment charge. Statistical analysis of the data showed partially significant differences between the mean values of different cross sections within the area which covers only about 5,000 sq km. The functions for estimating suspended sediment discharge, which state the average increase of the suspended sediment discharge in g/s with the water discharge in cu m/sec were calculated for 11 cross sections after the simplified method of Remy-Berzencovich (1960). Sediment discharges are tabulated. (Knapp-USGS)
W69-07758

DRIFT BALANCE OF THE KURA RIVER IN ITS LOWER COURSE,
Akademiya Nauk Azerbaidzhanskoi SSR, Baku. Institut Geografii.
S. G. Rustamov.
Comm of Surface Waters, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 75, pp 391-400, 1967. 10 p, 1 fig, 1 tab.

Descriptors: *Sediment transport, *Suspended load, *Regime, *River regulation, Reservoirs, River training, Water management (Applied), Bank erosion, Sedimentation.
Identifiers: *USSR, *Kura River (USSR), Arax River (USSR).

Construction of the Mingechaur reservoir on the Kura River, USSR, abruptly changed the river's characteristics, particularly its sediment load and meander form. Regulation changed annual streamflow from 18.7 cu km to 16.7 cu km. Suspended load decreased from 211 g/cu m to 25 g/cu m above the confluence of the Arax River and from 2,007 to 1,651 gm/cu m below the confluence. Deposition on the flood plain decreased from 38 to 19.2 million tons. The amplitude and rate of migration of meanders greatly decreased. (Knapp-USGS)
W69-07759

SEDIMENT TRANSPORTATION IN RIVER CHANNELS WITH FLOOD PLAINS,
Gidrometeorologicheskii Institut, Leningrad (USSR).
N. B. Barishnikov.
Comm of Surface Waters, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 75, pp 404-412, 1967. 9 p, 2 fig, 1 tab, 12 ref.

Descriptors: *Sediment transport, *Alluvial channels, *Model studies, *Floods, *Flood plains, Hydraulic models, Alluvium, Sediment load, Sediment discharge, Sands, Turbulence, Streamflow, Velocity.
Identifiers: USSR, Stream models.

The influence of turbulence on alluvial channel sediment load was studied in over 200 flume experiments. The channels studied had rectangular cross sections and unilateral rectangular flood plains. The channel discharge decreased markedly when the flood plain and channel discharged together. This decrease was directly proportional to flood plain hydraulic roughness. The mean channel velocity decreased and velocity distribution in the channel became more uniform when water flowed on the flood plain. (Knapp-USGS)
W69-07760

THE EFFECT OF WATER DETENTION STRUCTURES ON RIVER AND DELTA MORPHOLOGY,
Colorado State Univ., Fort Collins, Dept. of Civil Engineering; and Agricultural Research Service, Fort Collins, Colo. Northern Plains Branch.
H. Y. Chang, D. B. Simons, and R. H. Brooks.
Comm of Surface Waters, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 75, pp 438-448, 1967. 11 p, 6 fig, 1 tab.

Descriptors: *Sedimentation, *Bed load, *Deltas, *Channel morphology, Model studies, Hydraulic models, Alluvial channels, Dams, Banks, Beds, Channel improvements, Structures, Hydraulics, Flood control, Storage.
Identifiers: Delta morphology.

The effect of flood-water retarding and sediment detention structures upon river morphology, including aggradation of river channels and reservoir deltas, has been studied in a large laboratory model basin. Constant rates of water and sediment (essentially bed-materials) were fed into a channel with a resulting flow of water and sediment into a reservoir at a constant depth. The banks of the channel were made stable for most of the runs. The river and delta morphology are discussed in terms of channel aggradation and degradation induced by delta growth and a sudden change of sediment feeding rate, water discharge, reservoir base level, or delta thickness. Shape factor for deltas is defined as the width-length ratio of the deltas when approximated as the shape of an ellipse. The shape factor generally increases in value for deltas developed when the channel is aggrading, and decreases in value for deltas developed when the channel is degrading. The mechanics of river flow and the accompanying changes in delta shape are discussed in terms of equivalent stream length. (Knapp-USGS)
W69-07761

THE RESULTS OF CONTINUOUS BED LOAD MEASUREMENTS RELATED TO FLUCTUATIONS OF THE RIVER BED,
Netherlands Rijkswaterstaat, Arnhem. Section of River studies.
A. Zanen.
Comm of Surface Waters, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 75, pp 489-500, 1967. 12 p, 6 fig, 5 ref.

Descriptors: *Bed load, *Sampling, *Measurement, Laboratory tests, Dunes, Sediment transport, Model studies, Hydraulic models.
Identifiers: Bed load sampling.

The relation between bed load movement and location on duned beds was studied in the laboratory to determine optimum bed load sampling and sampler calibration techniques. Sand transport is intermittent, with maximum movement at dune crests and minimum movement just downstream. The amount of sand caught in a sampler depends on its position on dunes. Modification of sampling techniques to sample all parts of several dunes will give more representative results. (Knapp-USGS)
W69-07762

SEDIMENT TRANSPORTATION AND THE MEANS OF ITS ESTIMATION,
State Hydrological Inst., Leningrad (USSR).
N. S. Znamenskaja, A. N. Ljapin, and I. V. Popov.
Comm of Surface Waters, Proc Gen Assembly of Bern (Sept-Oct, 1967), Int Ass Sci Hydrol, Pub No 75, pp 507-516, 1967. 4 fig.

Descriptors: *Sediment transport, *Alluvial channels, *Measurement, *Estimating, Channel morphology, Dunes, Turbulence, Roughness (Hydraulic), Meanders.

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Identifiers: USSR, Sediment transport estimation.

River bed evolution is a form of sediment transportation by flowing water. River bed evolution can be divided into 2 types distinguished by dune motion of sediments and meandering. A system of characteristics expressing principal deformation features peculiar to different types of river bed evolution was elaborated. Mapping showed some relations between individual morphometrical characteristics, deformation velocity and influencing factors. By means of hydromorphological analysis, it is possible to simplify choice of engineering structures location, choose the most effective defense measures, and forecast river bed deformation. One of the computation methods is based on consideration of dune motion and its dependence on hydraulic factors, and may be used to solve many engineering problems, including bed-load discharge determination, channel form migration, minimum and maximum depths, channel sedimentation, erosion of the dune crest, etc. Another computation method correlates channel forms with abruptly changing flows. (Knapp-USGS)
W69-07763

TRANSPORT VELOCITIES OF SINGLE PARTICLES IN BED-LOAD MOTION,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.; and Uppsala Univ. (Sweden). Dept. of Physical Geography.
Nils Meland, and John Norrman.
Geogr Ann, Vol 48A, No 4, pp 165-182, 1966. 18 p, 6 fig, 1 tab, 28 ref.

Descriptors: *Sediment transport, *Bed load, *Model studies, *Hydraulic models, Laminar flow, Turbulent flow, Reynolds number, Particle size, Shape, Roughness (Hydraulic), Saltation, Velocity.
Identifiers: Bed load transport.

In order to determine the influence of shear velocity, bed roughness and moving particle diameter on particle bed-load transport, velocities of single spherical glass beads moving over beds of rhombohedrally packed spherical glass beads were determined under controlled laboratory conditions. A relationship between the position of zero water velocity and bed roughness is established. Three stages of particle motion are recognized from a plot of bead velocity on particle diameter. The degree of development of each is a function of all three major variables. An empirical solution is offered where particle velocity is considered a function of shear velocity, bed roughness, and particle diameter. A more detailed consideration of the forces which tend to propel and retard a moving particle leads to the development of a semi-empirical expression for the velocity of a single particle in contact-load motion. (Knapp-USGS)
W69-07769

SEDIMENTATION ENGINEERING CHAPTER VI: ECONOMIC ASPECTS OF SEDIMENTATION,
For primary bibliographic entry see Field 04D.
W69-07794

SEDIMENT RADIOACTIVITY IN THE COLUMBIA RIVER ESTUARY,
Oregon State Univ., Corvallis. Dept. of Oceanography.
For primary bibliographic entry see Field 05C.
W69-07851

PESTICIDE RESIDUES IN SEDIMENTS OF THE LOWER MISSISSIPPI RIVER AND ITS TRIBUTARIES,
National Communicable Disease, Atlanta, Ga.; Food and Drug Administration, Washington, D. C.; Agricultural Research Service, Oxford, Miss. Sedimentation Lab.; and Agricultural Research Service, Gulfport, Miss. Plant Pest Control Div.
For primary bibliographic entry see Field 05B.
W69-07921

STUDIES ON THE SAND TRANSPORT IN STREAMS WITH TRACERS,
Kyoto Univ. (Japan). Disasters Prevention Research Inst.
Katsumasa Yano, Yoshito Tsuchiya, and Masanori Michiue.
Bull of Disaster Prev Res Inst, Kyoto Univ, Vol 18, Part 3, No 141, pp 1-16, Feb 1969. 16 p, 18 fig, 2 tab, 11 ref.

Descriptors: *Sediment transport, *Stochastic processes, *Mathematical models, *Hydraulic models, Model studies, Flumes, Sediment discharge, Sediment load, Bed load, Sands, Gravels, Flumes, Streams.
Identifiers: Japan.

A stochastic model of the transport of uniformly graded sand and gravel in streams is proposed. The model was verified using colored sand as tracers in alluvial streams and in laboratory flumes. Model calculations were in good agreement with experimental values. Sand grains move in steps, with an average length of about 80-250 times grain diameter. Step length increases with flow intensity. At high intensity, sediment discharge increases with step length, but at low intensities, sediment discharge is a function only of probability of initiation of grain movement. (Knapp-USGS)
W69-07931

FLUVIATILE OBSTACLE MARKS FROM THE WADIS OF THE NEGEV (SOUTHERN ISRAEL),
Geological Survey of Israel (Jerusalem).
Iaakov Karcz.
J Sediment Petrol, Vol 38, No 4, pp 1000-1012, Dec 1968. 13 p, 15 fig, 39 ref.

Descriptors: *Scour, *Channel flow, *Stream erosion, Sedimentary structures, Ripple marks, Sands, Arid lands, Silts, Clay, Turbulence, Bed load.
Identifiers: Negev (Israel), Wadis, Current crescents.

Current crescents and several types of obstacle shadows, the result of both scouring and deposition, appear along the pebble-lined beds of the ephemeral streams (wadis) of the Negev. These structures are formed by secondary currents which originate when the main flow is deformed by obstacles within the stream path. The hydraulic mechanisms of the formation of the structures are described and shown by diagrams. (Knapp-USGS)
W69-07944

CARBONATE TURBIDITES, GULF OF MEXICO,
Texas A and M Univ., College Station. Dept. of Geology.
David K. Davies.
Contract No. 14-08-0001-10866 USGS. Proj No. 15265 Texas A and M. J Sediment Petrol Vol 38, No 4, pp 1100-1109, Dec 1968. 10 p, 8 fig, 1 tab, 29 ref.

Descriptors: *Sedimentation, *Carbonates, *Limestones, *Turbidity currents, *Gulf of Mexico, Continental slope, Oceans, Sediment transport, Provenance.
Identifiers: Carbonate turbidites.

Carbonates of shallow water origin have been recovered from an area of some 39,000 sq mi in the Gulf of Mexico abyssal plain. These carbonates occur most commonly as layers of variable thickness (2-120 cm) in cores of Pleistocene-Recent sediments. Cores from the southern edge of the abyssal plain reveal a remarkable lithologic simplicity and orderliness, characterized in general by a vertical repetition of members: (1) a basal white or light gray, medium calcilutite, 30 cm in average thickness, which is commonly cross-laminated and contains an abundant shallow water benthonic fauna; overlain by (2) a light olive-gray, fine calcilutite, some 35 cm in average thickness, which is commonly bioturbated and consists of a mixture of comminuted shells, micrite, and argillaceous lutite and which contains both planktonic and shallow water benthonic fauna; (3) an gray-olive black argillaceous lutite, 50 c average thickness, which may be bioturbat structureless, and which contains a scattered p tonic fauna. Each core consists of several sequences, each of which represents depo from a mature turbidity-current that originat the Campeche Shelf, and which was followed period of characteristic abyssal plain sediment of argillaceous lutites. Areal distribution of th bidites suggests that occasionally the travelled beyond the present northern limits abyssal plain--a total travel path of 350 miles tremendous quantities of detrital sediment originated from the Mexico and Texas contin shelves, as well as from the Mississippi River, buried the carbonate turbidites beyond depths or diluted these flows in the south northwest, and east of the abyssal plain. (K USGS)
W69-07945

REWORKING OF GLACIAL SEDIMENT THE NORTHWEST ARM, A FJORD- INLET OF THE SOUTHEAST COAST OF N SCOTIA,
Smithsonian Institution, Washington, D. C. D Sedimentology.
Daniel J. Stanley.
J Sediment Petrol, Vol 38, No 4, pp 1224- Dec 1968. 18 p, 14 fig, 43 ref.

Descriptors: *Estuaries, *Sedimentation, *G drift, Erosion, Deposition (Sediments), Sed transport, Silting, Partial size, Particle shape, ment distribution.
Identifiers: Halifax (Nova Scotia), Sedime working.

The morphology, water mass properties, and ments in a small fjord-like inlet on the At coast of Nova Scotia, the North West Arm, examined in an attempt to evaluate process lated to the reworking of glacial drift in the m environment. The Arm, an open system with cal, chemical, and biological exchanges with beyond its mouth, is not a simple 'sediment The present sediment distribution conforms c with morphological features and with patte current flow. The original Pleistocene diam till deposits (gravel to mud admixtures) have mechanically reorganized during the period fo ing submergence of the former glaciated Winnowing and by-passing, when carrie completion, result in the formation of gravel ments in areas strongly affected by currents the deposition of fine-grained material on les rent-agitated bottoms. Less well-sorted te varieties result from incomplete winnowing from the introduction of fine-grained mater coarse gravel 'lag' pavements. These interm sediment types, gradational between origin deposits and better sorted mud and gravel members, clearly do not fall in either reli modern sediment categories as usually de The patchy nature of the sediment distributio the wide range of textural types observed Arm are characteristics common of subm coastal embayments and shelves off glaciate gions in general. It is quite likely that some processes still active in the North West Arm the type that modified Pleistocene glacial dr continental margins during early phases transgression by the Holocene sea. (Knapp-U W69-07946

SEDIMENTATION IN AN ARCTIC LAKE,
Department of Energy, Mines and Reso Burlington (Ontario). Great Lakes Div.; an tawa Univ. (Ontario). Dept. of Geology.
J. P. Coakley, and B. R. Rust.
J Sediment Petrol, Vol 38, No 4, pp 1290- Dec 1968. 11 p, 7 fig, 2 tab, 18 ref.

Descriptors: *Sedimentation, *Arctic, * Cold regions, Silts, Sands, Mud, Permafrost, ing, Sediment transport, Deposition (Sedimen Identifiers: Stanwell-Fletcher Lake (Canada).

nwell-Fletcher Lake is 400 mi north of the Arc- Circle, covers 131 sq mi, and is over 100 m p. Its size and the severe climate restrict mer melting of ice to the margins. The ice insu- s the water, which remains essentially isother- , warming slightly from 1.3 to 1.6 deg C, during summer. Inflowing water is nearer 4 deg C, and efore sinks and mixes with the lake water, a cess which maintains thermal and chemical nogeneity in the lake and oxygenates the surfi- bottom sediment. Sedimentation is very slow ause of the short period of stream flow and the organic activity in the lake. Silty sand derived n river bed loads accumulates on shallow mar- l deltas and shelves. The sediment is poorly ed because ice cover prevents wave action and oval of the fine material to deeper water. Mud ved largely from the suspended loads of rivers, es slowly in the central part of the lake. Faint inae in the shelf sands may be varves, but the o water mud is structureless. Evidently seasonal mentary variations do not affect the center of lake, probably because ice cover minimizes sporting currents. The oxidation-reduction ndary in the sediment is at 5-20 cm, deeper in temperate lakes, because of oxidation at the bottom and slower reduction within the sedi- t. (Knapp-USGS)
9-07947

EMICAL CHANGES IN INTERSTITIAL TERS FROM CONTINENTAL SHELF SEDI- NTS,
umbia Univ., Dobbs Ferry, N. Y. Hudson Labs.; Rensselaer Polytechnic Inst., Troy, N. Y. Dept. eology.
ald M. Friedman, Burton P. Fabricand, Eugene nbimbo, Mary E.Brey, and John E. Sanders.
rk supported by Office of Naval Research. J ment Petrol, Vol 38, No 4, pp 1313-1319, Dec 8. 7 p, 2 fig, 3 tab, 19 ref. Contract No. Nonr- (84)ONR.

criptors: *Water chemistry, *Sediments, Atlan- Coastal Plain, Continental shelf, Diagenesis, gnesium, Calcium, Potassium, Chlorides, Mem- ne processes, Ion exchange, Clays, Sands, nity, Equilibrium.
ntifiers: Continental shelf sediments.

mistry of pore waters from cores from the inner outer shelf off Long Island, New York was pared with that of the overlying sea waters. es from the inner shelf consist of clean sands, reas those from the outer shelf contain mud. In types, the chlorinity and the Ca/Cl, K/Cl, and Cl ratios are higher in the interstitial waters in the overlying waters. The Mg/Cl and Li/Cl os are about the same, but Li/Cl ratios are er on the inner shelf than on the outer shelf. Sr/Cl ratio is highest for the surface waters, est for the interstitial waters, and of inter- iate values in bottom waters. Values of pH and are lower in the core waters than in the overly- waters. The decreases in pH and Eh below the er/sediment interface are attributed to the ac- y of anaerobic bacteria. The reasons for the r chemical changes may result from diagenetic nges. Clays may act as semipermeable mem- nes during compaction and retain salt while ex- sing less saline water. This does not seem ap- able to the clean sands of the inner shelf. The ease of Ca/Cl ratio may be a result of dissolu- of aragonite from shells in the enclosing sedi- nts. If true, it is surprising that the Sr/Cl ratio reases as the Ca/Cl ratio increases. The increase he K/Cl and Rb/Cl ratios may result from the olution of K-feldspar. (Knapp-USGS)
9-07948

ANIUM DISTRIBUTION IN ARAL SEA SEDI- NTS,
demiya Nauk SSSR. Institut Okeanologii.
. Kochenov, and G. N. Baturin.
l edition of Akad Nauk, SSSR, transl by Amer phys Union, Wash, DC. Oceanology, Acad Sci SSR, Vol 7, No 4, pp 484-487, 1967. 4 p, 1 fig, b, 7 ref.

Descriptors: *Lake beds, *Uranium radioisotopes, *Sediments, Water chemistry, Sands, Clays, Mud, Silts, Carbonates, Carbon, Estuarine environment, Detritus, Organic matter, Salinity.
Identifiers: *Russia, Aral Sea Sediments, Uranium bearing sediments.

Uranium distribution in the Aral Sea sediments was investigated by using samples collected in August to October 1965 and earlier publications. The Aral Sea, which is a shallow basin of mean depth of about 20 m, receives its water and minerals from the Amu Dar'ya and Syr Dar'ya Rivers, with the greater part of the sediments of the sea derived from the suspended matter of these rivers. The least uranium content (0.0001-0.0002%) is found in the sands and silty ooze of the coastal zone and is increased to 0.01% in the calcareous and argillaceous sediments of the central area of the basin. The distribution of uranium in the water over the sea area is uneven, varying from 0.00003-0.000035 g/l in the river estuaries to 0.00005-0.00006 g/l in the central part of the sea. It is of interest to note the sediment: lake water uranium content ratio which varies from 1:200 to 1:300, an extremely low ratio. (Gabriel-USGS)
W69-07977

RECENT SEDIMENTATION CONDITIONS IN THE ILE SAINT PAUL LAGOON,
Akademiya Nauk SSSR. Institut Okeanologii.
For primary bibliographic entry see Field 02H.
W69-07978

A CRITICAL REVIEW OF CONVENTIONAL BED LOAD FORMULAE,
Universityof Strathclyde, Glasgow (Scotland). Dept. of Civil Engineering.
John G. Herbertson.
J Hydrol, Vol 8, No 1, pp 1-26, May 1969. 26 p, 6 fig, 3 tab, 29 ref, append.

Descriptors: *Sediment transport, *Bed load, *Reviews, Suspended load, Simulation analysis, Mathematical models, Bibliographies, Synthetic hydrology, Mathematical studies, Channel morphology, Particle shape, Particle size.
Identifiers: *Similitude theory.

Certain of the conventional forms of bed load formulae are examined using similtude theory as a common basis of comparison. The particular form of similitude theory employed is the method of synthesis presented recently for sediment transport studies by Barr and Herbertson. It is emphasised that any bed load formula is at best an approximation due to the arbitrary nature of the subdivision of total sediment load into wash, suspended and bed load fractions. The particular formula chosen for examination are considered to be representative of bed load formula in general. It is shown that the formula are based on alternative forms of general similitude sediment transport equations and consist of incomplete versions of these equations. Most commonly omitted are terms such as the ratio of sediment to fluid density and the ratio of a linear channel dimension, say flow depth, to sediment grain size. This effectively limits the applicability of the formula to very narrow bands without which there can be little justification for comparison of results obtained by use of the formula. (Knapp-USGS)
W69-08003

SOME ECONOMIC ASPECTS OF URBAN SEDIMENTATION,
Resources for the Future, Inc., Washington, D. C.
For primary bibliographic entry see Field 04C.
W69-08110

2K. Chemical Processes

SOLUBILITY OF GYPSUM IN AQUEOUS ELECTROLYTES AS AFFECTED BY ION ASSOCIATION AND IONIC STRENGTHS UP TO 0.15M AND AT 25 DEG C,
California Univ., Davis. Dept. of Water Science and Engineering.
Kenneth K. Tanji.
Environ Sci and Technol, Vol 3, No 7, pp 656-661, July 1969. 6 p, 2 fig, 4 tab, 40 ref. Grant No. FR 00009 (NIH).

Descriptors: *Solubility, *Gypsum, *Computer programs, Aqueous solutions, Water chemistry, Ions, Electrolytes, Equilibrium, Solutes, Saline water systems, Arid lands.
Identifiers: FORTRAN program, Gypsum solubility.

A computer program was developed to calculate ion association and solubility of gypsum in aqueous solutions of Na, Mg, Ca, Cl, and sulfate at 25 deg C and low ionic strength. The FORTRAN program uses nonequilibrium ionic concentrations as input and calculates Debye-Huckel theory, solubility constant of gypsum, and dissociation constants of calcium sulfate, magnesium sulfate, and sodium sulfate ion to predict equilibrium concentrations. Predicted values agree well with observed values. (Knapp-USGS)
W69-07700

CHEMICAL EQUILIBRIA AND ZONING OF SUBSURFACE WATER FROM JACHYMOV ORE DEPOSIT, CZECHOSLOVAKIA,
Geological Survey of Czechoslovakia, Prague.
For primary bibliographic entry see Field 05G.
W69-07703

CHEMICAL PROPERTIES OF GROUND WATER AND THEIR CORROSION AND ENCRUSTATION EFFECTS ON WELLS,
Geological Survey, Washington, D. C.
Ivan Barnes, and Franke E. Clarke.
Geol Surv Prof Pap 4898-D, 1969. 58 p, 27 fig, 7 tab, 47 ref, 2 append.

Descriptors: *Water chemistry, *Water quality, *Water wells, *Well screens, *Fouling, Chemical potential, Corrosion, Well casings, Aquifers, Chemical reactions, Equilibrium, Corrosion control, Groundwater.
Identifiers: *Egypt, *West Pakistan, *Nigeria, Encrustation effects.

Well waters in Egypt, Nigeria, and West Pakistan were studied for their chemical properties and corrosive or encrusting behavior. From the chemical composition of the waters, reaction states with reference to equilibrium were tested for 29 possible coexisting oxides, carbonates, sulfides, and elements. Of the 29 solids considered, only calcite, calcium carbonate, and ferric hydroxide showed any correlation with the corrosiveness of the waters to mild steel (iron metal). All 39 of the waters tested were out of equilibrium with iron metal, but those waters in equilibrium or supersaturated with both calcite and ferric hydroxide were the least corrosive. Supersaturation with other solid phases apparently was unrelated to corrosion. A number of solids may form surface deposits in wells and lead to decreased yields by fouling well intakes or increasing friction losses in casings. Calcite, hausmannite, manganese spinel, three iron sulfides, copper hydroxide, and manganese hydroxide, were all identified in the deposits sampled. Of geochemical interest is the demonstration that simple stable equilibrium models fail in nearly every case to predict compositions of water yielded by the wells studied. Only one stable phase (calcite) was found to exhibit behavior approximately predictable from stable equilibrium considerations. (Knapp-USGS)
W69-07729

QUALITY OF SURFACE WATERS FOR IRRIGATION IN WESTERN STATES--1964.
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 03F.
W69-07732

HERMAN U. OF L. URBANA-CHAMPAIGN

EFFECTS OF GAMMA RADIATION ON ACCUMULATION OF MINERAL NITROGEN IN FRESH SOILS,
United Kingdom Atomic Energy Authority, Wantage (England). Research Group.
For primary bibliographic entry see Field 05G.
W69-07825

PROTISTS, PIGMENTS, AND PHOTOSYNTHESIS,
Brandeis Univ., Waltham, Mass. Dept. of Biology.
For primary bibliographic entry see Field 05A.
W69-07836

INTERACTING EFFECTS OF GAMMA RADIATION AND SODIUM HALIDE CONCENTRATIONS ON RAINBOW TROUT,
Utah State Univ., Logan. Ecology Center.
For primary bibliographic entry see Field 05C.
W69-07849

RECONNAISSANCE OF THE CHEMICAL QUALITY OF SURFACE WATERS OF THE SAN ANTONIO RIVER BASIN, TEXAS,
Geological Survey, Austin, Tex.
Jack Rawson.
Tex Water Develop Board Rep No 93, Apr 1969. 24 p, 9 fig, 6 tab, 25 ref.

Descriptors: *Water quality, *Water chemistry, *Texas, Streamflow, Data collections, Sampling, Chlorides, Sodium, Salts, Water pollution, Water sources.
Identifiers: *San Antonio River (Tex).

The kinds and quantities of minerals dissolved in surface waters of the San Antonio River basin are related principally to the geology of the area and to rainfall and streamflow characteristics. Municipal and industrial wastes have degraded the natural quality of water in some streams. Rocks exposed in the basin range in age from Cretaceous to Quaternary. The upper part of the basin is underlain by the Edwards and associated limestones and Glen Rose Limestone. Streams that traverse these outcrops usually contain less than 325 mg/l dissolved solids but are very hard. Principal chemical constituents are calcium and bicarbonate. Dissolved-solids content of water in the lower reach of Medina River averages more than 325 mg/l because of municipal and industrial pollution. The chemical composition of water in streams that traverse younger formations in the central and lower part of the basin is variable. However, the dissolved-solids content of most streams not appreciably affected by pollution averages less than 200 mg/l. Water in these streams usually is moderately hard. Although the chemical quality of water in the mainstem San Antonio River and the lower reach of Cibolo Creek is being degraded by municipal, industrial, and irrigation wastes, the discharge-weighted concentration of dissolved solids in both streams averages less than 500 mg/l. Water in both streams usually is very hard. The chloride content of surface waters in the basin generally averages less than 20 mg/l, except in areas where the chemical quality is being degraded considerably by pollution. The concentration of chemical constituents in surface waters throughout much of the basin is within limits recommended by the U.S. Public Health Service for domestic use. The waters also are suitable for most irrigation uses; however, the water throughout much of the basin is moderately hard or very hard and will require softening for most industrial uses. (Knapp-USGS)
W69-07927

CHEMICAL CHANGES IN INTERSTITIAL WATERS FROM CONTINENTAL SHELF SEDIMENTS,
Columbia Univ., Dobbs Ferry, N. Y. Hudson Labs.; and Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Geology.
For primary bibliographic entry see Field 02J.
W69-07948

UTILIZATION OF THE ANALOG COMPUTER FOR SIMULATING THE SALINITY FLOW SYSTEM OF THE UPPER COLORADO RIVER BASIN,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 02E.
W69-07957

URANIUM DISTRIBUTION IN ARAL SEA SEDIMENTS,
Akademiya Nauk SSSR. Institut Okeanologii.
For primary bibliographic entry see Field 02J.
W69-07977

THE OCEANIC SIGNIFICANCE OF RIVER ION DISCHARGE,
Gidrometeorologicheskii Institut, Leningrad (USSR).
For primary bibliographic entry see Field 02L.
W69-07980

CARBONATE EQUILIBRIA AND RADIOCARBON DISTRIBUTION RELATED TO GROUNDWATER FLOW IN THE FLORIDAN LIMESTONE AQUIFER, USA,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02F.
W69-07985

SILICATE REACTIONS--A REVIEW,
Bureau of Mines, Bartlesville, Okla.
A. G. Collins, and Lillie R. Fisher.
Office Saline Water Res and Develop Progr Rep No 307, 1969. 99 p, 2 index. OSW 14-01-0001-1146.

Descriptors: *Water chemistry, *Silicates, *Chemical reactions, *Reviews, *Bibliographies, Corrosion control, Diagenesis, Weathering, Hydration, Aqueous solutions, Saline water, Fresh water, Chemical analysis.
Identifiers: Silicate chemistry.

Recent literature on silicate-water reactions is reviewed and a bibliography indexed by author and title is compiled. Subjects covered in detail include analytical techniques, buffering in aqueous solution, diagenesis and weathering, hydrothermal reactions in saline and nonsaline media, and corrosion prevention. (Knapp-USGS)
W69-08022

HYDRODYNAMIC STUDIES FOR ELECTRODIALYSIS,
McDonnell-Douglas Astronautics Co., Newport Beach, Calif.
For primary bibliographic entry see Field 03A.
W69-08114

2L. Estuaries

A RECONNAISSANCE STUDY OF THE CHESAPEAKE BAY,
Regional Planning Council, Baltimore, Md.
For primary bibliographic entry see Field 05G.
W69-07742

TRACER STUDY OF THE PHOSPHORUS CYCLE IN SEA WATER,
Dalhousie Univ., Halifax (Nova Scotia). Inst. of Oceanography.
For primary bibliographic entry see Field 05B.
W69-07822

SEDIMENT RADIOACTIVITY IN THE COLUMBIA RIVER ESTUARY,
Oregon State Univ., Corvallis. Dept. of Oceanography.
For primary bibliographic entry see Field 05C.
W69-07851

CHLORINATED HYDROCARBON PESTICI IN CALIFORNIA BAYS AND ESTUARIES,
California State Dept. of Fish and Game, M Park. Marine Resources Operations.
For primary bibliographic entry see Field 05B.
W69-07920

COASTAL WATERS AND THE NATION,
National Council on Marine Resources and gineering Development, Washington, D. C.
For primary bibliographic entry see Field 06B.
W69-07923

THE HUMAN ECOLOGY OF COASTAL FL HAZARD IN MEGALOPOLIS,
Toronto Univ. (Ontario), and Clark Univ., cester, Mass.
For primary bibliographic entry see Field 06G.
W69-07942

CHEMICAL CHANGES IN INTERSTI WATERS FROM CONTINENTAL SHELF S MENTS,
Columbia Univ., Dobbs Ferry, N. Y. Hudson L and Rensselaer Polytechnic Inst., Troy, N. Y. of Geology.
For primary bibliographic entry see Field 02J.
W69-07948

MINERAL RESOURCES OF THE WO OCEAN.
Geological Survey, Washington, D. C.; R Island Univ., Newport; and Department of Navy, Washington, D. C.
For primary bibliographic entry see Field 06B.
W69-07973

THE OCEANIC SIGNIFICANCE OF RIVER DISCHARGE,
Gidrometeorologicheskii Institut, Lenin (USSR).
O. A. Alekin.
Eng edition of Akad Nauk, SSSR, transl by A Geophys Union, Wash, DC. Oceanology, Aca of USSR, Vol 7, No 4, pp 431-435, 1967. 5 p, 1 tab, 10 ref.

Descriptors: *Water chemistry, *Ion trans *River flow, *Ocean circulation, Disch (Water), Land, Chemical analysis, Precipit (Atmospheric), Salt balance, Sodium, Potass Calcium, Chlorine, Ions, Water temperature, C um carbonate, Saturated flow, Hydrostatic sure.
Identifiers: Oceanic river, Ion discharge.

Salt balance and river ion discharge were vestigated on the basis of earlier publications the data recorded by the Research Vessel Yu Skokal'skiy. The data shows that the amount o discharge from the continents into the ocea 2,310 million tons a year when hydrocarbo ions are expressed in the form of carbonate ion 3,171 million tons a year when they are expre in terms of bicarbonate ions. This quantity prises only the 7 principal ions: Cl ion, sulfate bicarbonate ion, Na ion, K ion, Mg ion, and Ca if the amount of water discharged by the rivers the ocean is assumed to be 35,560 cu km per y The study of the oceanic ion exchange, preci tion, and saturation processes shows that oceanic water can be subdivided in depth in zones which, to some extent, are characterize their own ion contents and exhibit their own sa tion and particle dissolution processes. (Gab USGS)
W69-07980

A SYMPOSIUM ON ESTUARINE FISHERIES
American Fisheries Society, Washington, D. C.

Roland F. Smith, Chairman. Amer Fish Soc Publication No 3, Proc 94th Annu Meeting,

4, Atlantic City, N J, 1966. 154 p, 21 fig, 10
e, 21 tab, 386 ref.

criptors: *Estuarine fisheries, *Estuaries,
heries, *Ecology, Stream fisheries, Nutrients,
luctivity, Water pollution effects, Water pollu-
control, Pesticides, Water management (Ap-
l), Pollution abatement.
tifiers: Estuary fisheries symposium.

arine fisheries are discussed in a symposium of
apers in the fields of the estuarine ecosystem,
abitat for fishery organisms, man's impact on
aries, and fishery management. Manmade and
ral estuarine ecologic problems and their solu-
s are discussed from the points of view of
ral specialties including ecology, sports fishe-
commercial fisheries, shell fisheries, water pol-
n control, water resources management, and
strial development management. (Knapp-
S)
-07986

**UMERICAL MODEL FOR THE SIMULA-
N OF TIDAL HYDRODYNAMICS IN SHAL-
W IRREGULAR ESTUARIES,**
s Univ., Austin. Hydraulic Engineering Lab.
k D. Masch, N. J. Schanker, M. Jeffrey, R. J.
des, and W. A. White.
nical Report HYD 12-6901, February 1969.
p, 1 tab, 50 fig, 10 ref, 1 append. OWRR Pro-
C-1158. Available from Clearinghouse as PB
834 at $3.00 in paper copy and $0.65 in
ofiche.

criptors: *Estauries, *Mathematical models,
city.
tifiers: *Tidal hydrodynamics, *Tidal am-
des, Finite difference methods, Net flows, Cir-
tion patterns, Tidal excursions, Tidal prisms,
vective-dispersion transport.

ming complete vertical mixing, a two-dimen-
al time dependent model is described which
ides spatial and temporal variations of tidal
s and amplitudes. The model accounts for vari-
physiographic features found in shallow estua-
variable inflows, low tidal action, and other
ologic characteristics. The model further pro-
s for the inclusion of wind stress and Coriolis
es. The basic outputs from the model are the
histories of tidal amplitude and velocity in
of two spatial coordinate directions. Data that
be obtained from the model include phase rela-
s, time of flood, ebb, and slack tides, net flows,
lation patterns, tidal excursions, and tidal
ns. The model is designed in such a manner
its basic output serves as directed input to a
vective-dispersion model. Although dispersion
eling is not discussed in this report, the inter-
between these two models is described where
opriate, as the output from the tidal
odynamic model is determined in part by the
irements for convective-dispersion or trans-
models.
-08112

WATER SUPPLY AUGMENTATION AND CONSERVATION

. Saline Water Conversion

**ALTING SALINE IRRIGATION WATER
PLIES FOR AGRICULTURE - A CASE
DY - LOWER COLORADO RIVER BASIN,**
,
eau of Reclamation, Denver, Colo.; Bureau of
lamation, Boulder City, Nev.; and Office of
ne Water, Washington, D. C.
n T. Maletic, Milton S. Sachs, and Elwyn S.
us.
. Symp Nuclear Desalination, Int At Energy Ag,
drid, Spain, Nov 1968. 19 p, 4 fig, 7 tab, 12 ref.

Descriptors: *Demineralization, *Irrigation water, *Saline water, Costs, Agriculture, Benefit-cost ratios, Brine disposal, Crops, Field tests, *Electrodialysis, Water treatment, Weather modification, Salt tolerance, Arizona, Economics, Salinity.
Identifiers: *Multistage flash distill, Interbasin water transfer, Crop yield, Lower Colorado River Basin, Irrigation requirement.

A study was performed to evaluate potential applications of multistage flash distillation and electrodialysis processes for desalting saline irrigation water near Yuma, Ariz. The investigation determined the associated costs and benefits and gave benefit-cost ratios. Benefits from desalting are generated by shifts to more profitable cropping patterns, increasing crop yields, reducing water use, reducing costs for water application and drainage, and increasing the flow of farm products. Costs are based on project features such as desalting plants and steam generating equipment, raw water collection facilities, storage reservoirs, conveyance and distribution systems, brine disposal systems, blending facilities, gypsum addition systems, and water treatment facilities. Desalting is expected to find many important applications to agriculture in the near-term future. Competition with other water development possibilities such as interbasin water transfer, weather modification, new salt-tolerant crop varieties, and structural and nonstructural salinity control measures on streams will be involved. (USBR)
W69-07801

MINERAL RESOURCES OF THE WORLD OCEAN.
Geological Survey, Washington, D. C.; Rhode Island Univ., Newport; and Department of the Navy, Washington, D. C.
For primary bibliographic entry see Field 06B.
W69-07973

SILICATE REACTIONS--A REVIEW,
Bureau of Mines, Bartlesville, Okla.
For primary bibliographic entry see Field 02K.
W69-08022

DESALTING,
Office of Saline Water, Washington, D. C.
Joseph J. Strobel.
Water Reuse, Amer Inst Chem Eng Progr Symp, Ser No 78, Vol 63, pp 114-119, 1967. 6 p, 9 ref.

Descriptors: *Desalination, *Water treatment, *Water costs, Desalination apparatus, Desalination processes, Water supply, Water yield, Water utilization, Saline water, Sea water.
Identifiers: Desalination economics.

Desalting is expected to be an important future source of new freshwater supply. Current technology includes distillation, membranes, crystallization, and ion exchange. Additional research is necessary to lower desalting costs further. Desalting should be considered with other alternatives in development of any incremental water supply program. Current developments are solving technical limitations. Economic possibilities for providing municipal and industrial water are expanding. Future projections of desalting seawater in large plants in the early 1970's are in the range of 22 cents/1,000 gal. and 15 cents or lower after 1975 if predicted low-cost energy is available. Summaries of recent feasibility studies for desalting plants are given and the relation of desalting to pollution is discussed. (Knapp-USGS)
W69-08044

VACUUM FREEZING VAPOR COMPRESSION PROCESS: ONE AND FIVE MILLION GALLON PER DAY DESALTING PLANTS,
Colt Industries, Inc., Beloit, Wis.
R. Consie, R. Darling, D. Emmermann, J. Fraser, and W. Johnson.
Office of Saline Water, Research and Development Progress Report No 451, May 1969. 67 p. OSW 14-01-0001-532.

Descriptors: *Desalination processes, *Freezing, *Cost analysis.
Identifiers: *Vacuum freezing, *Cost studies, *Cost estimates, Direct melting.

Cost studies have been prepared for one and five million gpd vacuum freezing vapor compression desalting plants. These plants use 500,000 gpd factory assembled units in groupings of two and ten to form the desalting plants. Costs for 1 and 5 million gpd plants are 61.5 and 51.3 cents per 1000 gallons respectively. Capital costs of the plants are $1.26 and $1.10 per gallon of daily capacity. The estimated power consumption is 27 KWH/1000 gallons. Fully automatic operation of the plants is assumed thus reducing the labor costs to a minimum. The 500,000 gpd unit is based on the use of a direct melting concept. (Gransee-Office of Saline Water)
W69-08113

HYDRODYNAMIC STUDIES FOR ELECTRODIALYSIS,
McDonnell-Douglas Astronautics Co., Newport Beach, Calif.
G. Belfort, and G. A. Guter.
Office of Saline Water R and D Report No 459, 1969. 144 p. OSW 14-01-0001-1313.

Descriptors: *Desalination, *Electrodialysis, *Membrane process, Hydrodynamics, Screen spacers.
Identifiers: *Desalination apparatus, *Electrochemistry, Solution velocity, Current density.

The hydrodynamic effectiveness of various spacer screens for electrodialysis was studied with the aid of a novel photographic technique in which exposed photographic paper was used in the place of ion-selective membranes, and photographic developer was used in the place of brine. This technique produced a visual record of the membrane-solution interfacial flow patterns in electrodialysis cells. Additional tests were conducted and criteria established for the characterization of each screen with respect to porosity, dead flow area, drag coefficient, and influence on electrical resistance. All of the experimental work was based on the installation of one or more layers of each candidate screen in the open central portion of a 40 mil thick rectangular gasket. The experiments demonstrated that some screens are considerably more effective than others in improving electrodialysis performance, especially at flow rates that give Reynolds numbers greater than 180. Seven (out of 21) of the more promising screens were further evaluated in electrodialysis batch tests to determine how current efficiency, membrane stack pressure drop, and total power requirements vary with flow rate. Two new materials, not previously used in commercial electrodialysis equipment are recommended for further study. (Mintz-Office of Saline Water)
W69-08114

3B. Water Yield Improvement

NATURAL STORAGE TANKS USED TO REFILL THE THAMES RIVER,
Water and Sewage Works, Chicago Ill.
For primary bibliographic entry see Field 04B.
W69-07701

GROUND-WATER RESOURCES OF THE WIND RIVER INDIAN RESERVATION, WYOMING,
Geological Survey, Washington, D. C.
Laurence J. McGreevy, Warren G. Hodson, and Samuel J. Rucker.
Geol Surv Water-Supply Pap 1576-I, 1969. 145 p, 15 fig, 3 plate, 7 tab, 67 ref.

Descriptors: *Water resources, *Groundwater, *Indian reservations, *Wyoming, Aquifers, Geolo-

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gy, Water wells, Water quality, Water yield, Recharge, Hydrologic data, Data collections, Water levels, Hydrogeology, Groundwater basins, Water sources.
Identifiers: *Wind River Indian Reservation (Wyo).

The potential yield and quality of water from most rocks in the Wind River Indian Reservation, Wyoming, are poorly known, but estimates may be based on local well data and on data concerning similar rocks in nearby areas. Yields of more than 1,000 gpm are possible from the Ordovician to Pennsylvanian limestones, dolomites, and sandstones. Total dissolved solids range from about 300 to 3,000 ppm. Yields of as much as several hundred gpm are possible from Jurassic and Triassic sandstones. Dissolved solids are generally high. Most wells in Cretaceous rocks yield less than 20 gpm. Dissolved solids range from about 200 to 5,000 ppm. Many parts of the Wind River Irrigation Project have become waterlogged. The relations of drainage problems to geology in the irrigated areas are partly defined by sections drawn on the basis of test drilling. Water from underground storage in alluvium could supplement irrigation water from surface sources in some areas to reduce the need for additional surface-storage facilities as well as to alleviate drainage problems in the irrigated areas. (Knapp-USGS)
W69-07731

WATER RESOURCES OF THE BELLE RIVER BASIN, SOUTHEASTERN MICHIGAN,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07C.
W69-07734

EVAPOTRANSPIRATION BY WOODY PHREATOPHYTES,
Geological Survey, Carson City, Nev.
For primary bibliographic entry see Field 02D.
W69-07928

WATER IN KENTUCKY,
Geological Survey, Washington, D. C.
R. A. Krieger, R. V. Cushman, and N. O. Thomas.
Kentucky Geol Surv Ser 10. Spec Publication No 16, 1969. 51 p, 23 fig, 39 photo, 4 tab, 126 ref.

Descriptors: *Water resources, *Groundwater, *Surface waters, *Kentucky, Bibliographies, Water utilization, Water quality, Streamflow, Evaporation, Reservoirs, Climatology, Precipitation (Atmospheric), Runoff, Recharge.
Identifiers: Kentucky water resources.

The water resources, water use, water problems, and water law of Kentucky are discussed in a publication intended for public education to increase knowledge of the nature, availability, and management of water. Data on water quality, water use, streamflow, groundwater level, reservoir capacity and precipitation are tabulated. A bibliography of Kentucky water information is included. (Knapp-USGS)
W69-07943

WATER DISPOSITION IN A STREAM CHANNEL WITH RIPARIAN VEGETATION,
Arizona Agricultural Experiment Station, Tucson; Agricultural Research Service, Tucson, Ariz. Southwest Watershed Research Center; and Arizona Univ., Tucson. Dept. of Soil Physics.
Hasan K. Qashu, and D. D. Evans.
Soil Sci Soc Amer Proc, Vol 31, No 2, pp 263-269, Mar-Apr 1967. 7 p, 9 fig, 4 tab, 14 ref.

Descriptors: *Riparian water loss, *Riparian plants, *Streamflow, Evapotranspiration, Consumptive use, Transpiration, Storage, Seepage, Banks, Alluvial channels, Specific yield, Water levels.
Identifiers: Streamflow loss.

Water losses along stream channels in the semiarid southwestern United States are of utmost importance when considering water disposition and water yields from a watershed. An analysis is described for estimating the disposition along a reach of a natural stream channel with a riparian vegetation and impermeable bedrock at a shallow depth. Results for one annual cycle are presented which indicate the quantity of water removed from the stream channel reach by various processes. Methods were adapted for the particular set of conditions to measure subsurface water flow and water storage in the channel alluvium. Subsurface water flow was calculated from Darcy's equation. Water storage was estimated from water content, water table elevation, specific yield and volume of alluvium measurements. Four distinct water-use periods were apparent within a yearly cycle, each expressed by a separate water balance equation. Water losses by evapotranspiration were estimated from these equations. For example, 9 mm of water were estimated to be lost per day by transpiration of the riparian vegetation during the months of May and June, a time of water shortage in the area. Total depth of annual water loss by evapotranspiration from the channel reach was estimated to 131 cm of water (4.3 acre-ft/acre). (Knapp-USGS)
W69-07976

WATER 'REQUIREMENTS': THE INVESTMENT DECISION IN THE WATER SUPPLY INDUSTRY,
Manchester Univ., (England).
For primary bibliographic entry see Field 06D.
W69-08097

3D. Conservation in Domestic and Municipal Use

WATER REUSE IN ISRAEL,
Water Planning for Israel Ltd., Tel Aviv.
For primary bibliographic entry see Field 05D.
W69-08037

THE ECONOMIST AND THE 'NEW' CONSERVATION,
British Columbia Univ., Vancouver.
Anthony Scott.
Planning 1968, Selected Papers from the ASPO National Planning Conference, San Francisco, pp 277-291, May 4-9, 1968. 15 p, 21 ref.

Descriptors: *Conservation, *Natural resources, Future planning, Economics, Pollution, Industries, Economic impact, Government, Cost-benefit analysis, Demand, Water resources, Finance, Evaluation, Welfare economics.
Identifiers: *Regional planning, Industrial development, Social wealth, Primary beneficiaries, Valuation.

The author admits that conservation may stand in the way of economic development. The possibility of influencing the rate of development was glossed over in the old conservation. The new conservation is concerned with transferring natural products from present uses in favor of different present uses. The tools of economics are inadequate for handling this type of policy. The author assigns to economists with the following tasks: (1) discovering the abstract or theoretical categories within which conservation demands, if they are found to exist, are to be found; (2) measuring the strength of these demands; and (3) comparing conservation demand with developmental demand. The remainder of the article is devoted to an analysis of these suggestions. Thus, although not specifically concerned with water resources, the analysis of economics in conservation should prove useful in the area of water resource development. (Murphy-Rutgers)
W69-08072

3E. Conservation in Industry

CONSERVATION OF WATER BY REUSE SOUTH AFRICA,
Council for Scientific and Industrial Research, toria (South Africa).
For primary bibliographic entry see Field 05D.
W69-08031

CONSERVATION OF WATER BY REUSE ITALY,
Azienda Acquedotto Municipale di Torina (Ita
For primary bibliographic entry see Field 05D.
W69-08033

CONSERVATION OF WATER BY REUSE MEXICO,
Celulosa y Derivados, S.A., Monterrey (Mexic
For primary bibliographic entry see Field 05D.
W69-08034

WATER REUSE IN WEST GERMAN IND TRY,
Ruhrverband, Essen (West Germany).
For primary bibliographic entry see Field 05D.
W69-08035

THE UTILIZATION OF MUNICIPAL WAS WATER IN JAPAN,
Ebara-Infilco Co., Tokyo (Japan).
For primary bibliographic entry see Field 05D.
W69-08036

CONSIDERATIONS ON THE REUSE WATER IN CERTAIN INDUSTRIES,
Centre Belge d'Etude et de Documentation Eaux (Liege).
For primary bibliographic entry see Field 05D.
W69-08038

CONSERVATION OF WATER BY REUSE THE UNITED STATES,
Celanese Corp. of America, New York.
For primary bibliographic entry see Field 05D.
W69-08039

SUCCESSES AND FAILURES IN WA REUSE,
Cosden Oil and Chemical Co., Big Spring, Tex.
For primary bibliographic entry see Field 05D.
W69-08051

HISTORY AND POSSIBLE FUTURE OF MU PLE REUSE OF SEWAGE EFFLUENT AT ODESSA, TEXAS INDUSTRIAL COMPLEX.
Aetron, Covina, Calif.; and El Paso Products Odessa, Tex.
For primary bibliographic entry see Field 05D.
W69-08052

WATER REQUIREMENTS AND USES ARIZONA MINERAL INDUSTRIES,
Bureau of Mines, Denver, Colo. Div. of Mi Resources.
M. M. Gilkey, and Robert T. Beckman.
Bur of Mines Inform Circ No 8162, 1963. 97 p fig, 8 tab, 8 ref.

Descriptors: *Water utilization, *Ariz *Mineral industry, Mills, Mining, Water re Water quality, Mine water, Industrial water, C ing water, Recirculated water.
Identifiers: Metals industry.

The effects of water shortage on Arizona's min industries are described. The information was tained in interviews with company representati

erations covered included all metal mines using bstantial quantities of water and all concentra- rs and smelters. Also included in the survey were operations in the nonmetallic group; 22 in the ting, metal-fabricating, and metal-forming tegories; 1 public-utility power company; and 6 ter companies. At many operations, inadequacy the supply necessitated large-scale recirculation. w water from 6 of 21 sources sampled is ackish, and 8 of 11 samples of recirculated water re brackish. Cost of new water from company- ned wells at 14 operations ranged from 1.0 cent r 1,000 gal to 57.7 cents per 1,000 gal, with an erage of 12.5 cents per 1,000 gal, including wer, labor, and supplies. Recirculation costs for wer, labor, and supplies at 3 copper operations nged from 1.0 cent to 1.8 cents per 1,000 gal. e mineral-product value of copper, lead, zinc, d byproducts is equivalent to $15.27 for each 00 gal of new water and $26.29 for each 1,000 of consumed water. Thus, a much greater um in product value can be obtained from water ed for mineral production rather than for the oduction of many other commodities. (Knapp-GS)
69-08058

F. Conservation in Agriculture

DROLOGIC CONDITIONS IN THE GILA ND BASIN, MARICOPA COUNTY, IZONA,
ological Survey, Phoenix, Ariz.
S. Stulik, and Otto Moosburner.
iz State Land Dep Water-Resources Rep No 39, r 1969. 63 p, 10 fig, 4 tab, 19 ref.

scriptors: *Water level fluctuations, *Water ources, *Groundwater, *Surface waters, rizona, Irrigation water, Water wells, Data col- tions, Irrigation, Water supply, Streamflow, servoirs, Infiltration, Water yield.
ntifiers: Gila Bend (Ariz), Gila River.

oundwater from irrigation wells and surface ter diverted from the Gila River supply the water ed to irrigate about 20,000 acres of cultivated d in the Gila Bend basin. The depth to water nged from less than 50 to more than 350 ft below land surface in spring 1966. Changes in water els vary with the amount and distribution of mpage. The rate of water-level decline in the inbow Valley areas has decreased markedly ce 1961, probably in response to decreased mpage. Near Gila Bend, water levels have clined from 20 to 60 ft since 1953, but in the rus Valley area north of Theba, water levels ve risen since 1953. In 1965, about 115,000 re-ft of groundwater was pumped for agricultural , and 500 acre-ft was pumped for domestic use. st of the water sampled contained fluoride in ex- s of the recommended limits. The mean annual face-water inflow to the Gila Bend basin for the 60-65 water years was 15,930 acre-ft. During the od of January 1966, about 407,000 acre-ft of ter passed Gillespie Dam, but only about 5,000 acre-ft of water passed Painted Rock m. A large part of the flow loss (150,000 acre-ft) obably went into groundwater storage. Well scriptions, water chemical analyses, and driller's s are tabulated. (Knapp-USGS)
69-07712

ALITY OF SURFACE WATERS FOR IR- GATION IN WESTERN STATES--1964.
ological Survey, Washington, D. C.

ol Surv Water-Supply Pap 1960, 1969. 144 p, 2 1 plate, 18 ref.

scriptors: *Water quality, *Irrigation water, ata collections, Water analysis, Surface waters, inity, Salt balance, Water chemistry, Water ources.
ntifiers: Irrigations water quality, Western U. S.

Water chemical quality data from 72 irrigation network stations west of the Mississippi River are presented. Each record includes location, a list of available records, extremes, runoff, silica, Ca, Mg, Na, K, bicarbonate, carbonate, sulfate, Cl, F, nitrate, B, total solids, % Na, SAR, specific conductance, and pH. (Knapp-USGS)
W69-07732

PEAK FLOW REQUIREMENTS FOR SPRINKLER IRRIGATION OF ORCHARDS AS AFFECTED BY SOIL TEXTURE AND PEAK EVAPOTRANSPIRATION,
Department of Agriculture, Summerland (British Columbia).
J. C. Wilcox.
Can J Soil Sci, Vol 49, No 1, pp 39-45, Feb 1969. 7 p, 1 fig, 3 tab, 15 ref.

Descriptors: *Sprinkler irrigation, Consumptive use, Duty of water, Orchards, *Soil texture, *Evapotranspiration, *Water requirements, Cover crops, Irrigation efficiency, Bibliographies, Irrigation systems, Field investigations, Climates, Soil moisture, Soil profiles, Evaporation.
Identifiers: *Irrigation requirement, Evaporimeters.

A scheduling procedure was used in 17 orchards from 1962 through 1965 to determine the peak flow of irrigation water required per unit area of land. Irrigation was by the sprinkler method with portable pipe settings of 12 hours. Peak flow was determined on a steady-flow basis during periods of peak evapotranspiration. Evapotranspiration (ET) was determined with evaporimeters. The texture and the water-holding capacity of the soil were also determined. Highly significant coefficients of correlation were obtained between the peak flow required and (1) percent sand, (2) average ET per day during the period of peak ET, (3) depth of water applied at each irrigation, and (4) length of irrigation interval. High correlation coefficients were also obtained among the factors studies. Regression of percent sand and peak ET on peak flow accounted for 90.6% of the variations in peak flow; regression of depth per application and length of irrigation interval accounted for 84.1%. Peak flow was affected directly by the depth of water applied at each irrigation and by the length of the safe irrigation interval, and indirectly by other factors. (USBR)
W69-07780

HYDRAULIC PROPERTIES OF A CLAY LOAM SOIL AND THE FIELD MEASUREMENT OF WATER UPTAKE BY ROOTS: 1. INTERPRETATION OF WATER CONTENT AND PRESSURE PROFILES,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02G.
W69-07966

HYDRAULIC PROPERTIES OF A CLAY LOAM SOIL AND THE FIELD MEASUREMENT OF WATER UPTAKE BY ROOTS: 2. THE WATER BALANCE OF THE ROOT ZONE,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02G.
W69-07967

HYDRAULIC PROPERTIES OF A CLAY LOAM SOIL AND THE FIELD MEASUREMENT OF WATER UPTAKE BY ROOTS: 3. COMPARISON OF FIELD AND LABORATORY DATA ON RETENTION AND OF MEASURED AND CALCULATED CONDUCTIVITIES,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02G.
W69-08025

ECONOMIC EVALUATION OF PUBLIC IRRIGATION DEVELOPMENT,
Economic Research Service, Washington, D. C.
Clyde E. Stewart.
Economics and Public Policy in Water Resource Development, Ames, Iowa State University Press, 1965, pp 107-126, 20 pp, 2 tab, 5 ref. Edited by S. C. Smith and E. N. Castle.

Descriptors: *Water resources development, *Pricing, *Evaluation, *Irrigation, *Decision-making, River basin, Resources, Value, Budgeting, Measurement, Full employment, Soil classifications, Capital, Land, Reclamation.
Identifiers: *Primary agricultural development, *Price projections, *Residual approach, *Data, *Quantification, Discounting, Opportunity costs, Factor process.

This article points to a basic quantification problem in the description and measurement of physical resources for evaluation purposes. This problem is due to a lack of fully developed soils classification, a lack of availability of measurements of water supplies and efficiencies under farming conditions, and a lack of adequate production functions for various land and water situations. All of these inadequacies place severe initial restrictions on evaluation of water development and use. Although government participation in water resource development helps to fill the inadequacy of the market and pricing system, acceptance of market prices in their entirety may hinge on the goals of government activity; these goals are not yet clearly stated. Procedures and analytical techniques evolve from legislation, and public goals reflected in such legislation may actually be in conflict with over-all decision making in terms of resource investments. Goals specified for a program may not be relevant to a rigid opportunity-cost view of resource alternatives. Apparently, then, quantification for evaluation purposes is modified by purposes and goals. But resource evaluation analysis is an effective screening device and a necessary element in decision-making. (Murphy-Rutgers)
W69-08086

ANALYSIS OF SMALL WATER MANAGEMENT STRUCTURES IN IRRIGATION DISTRIBUTION SYSTEMS,
For primary bibliographic entry see Field 04A.
W69-08117

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

FORMATION OF FLOOD PLAIN LANDS,
Army Engineer District, New Orleans, La.
Walter C. Carey.
ASCE Proc, J Hydraul Div, Vol 95, No HY3, Pap No 6574, pp 981-994, May 1969. 14 p, 7 fig, 11 ref.

Descriptors: *Flood plains, *Alluvial channels, *Rivers, *Geomorphology, Sedimentation, Erosion, Meanders, River training, Sediment load, Stream stabilization, Eddies, Turbulence, Streamflow, Deposition (Sediments).
Identifiers: Flood plain formation.

Alluvial rivers migrate laterally and longitudinally and generate new flood plain lands. Lands are formed by sheet accretion, point bar accretion, eddy accretion and back-swamp accretion. The type of flood plain land generated is determined by the nature of the local river migration or movement. With river migration, caving banks are formed, and under certain conditions, the caves can be very sudden, extensive, and dangerous to man in developed or urban areas. (Knapp-USGS)
W69-07707

IERWU U. OF L. URBANA-CHAMPAIGN

FLOOD PLAIN INFORMATION-GOODNIGHT ARROYO, DRY CREEK AND WILD HORSE-DRY CREEK, PUEBLO, COLORADO.
Corps of Engineers, Albuquerque, N. Mex.

Corps Eng Flood Plain Rep, April 1969. 52 p, 11 fig, 12 plate, 13 tab.

Descriptors: *Floods, *Flood damage, *Colorado, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Pueblo (Colorado), Standard project flood, Intermediate regional flood.

Flooding of the Goodnight Arroyo, Dry Creek, and Wild Horse Creek, Pueblo, Colorado is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-07708

FLOOD PLAIN INFORMATION OF ARKANSAS RIVER AND TRIBUTARIES, RUSSELLVILLE AND DARDANELLE, ARKANSAS.
Corps of Engineers, Little Rock, Ark.

Prepared for cities of Russellville and Dardanelle. Corps Eng Flood Plain Rep, Feb 1969. 57 p, 22 fig, 35 plate, 15 tab.

Descriptors: *Floods, *Flood damage, *Arkansas, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Russellville (Ark), Dardanelle (Ark), Standard project flood, Intermediate regional flood.

Flooding of the Arkansas River, Russellville and Dardanelle, Arkansas is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoining and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-07715

FLOOD PLAIN INFORMATION OF SWEETWATER RIVER, SAN DIEGO COUNTY, CALIFORNIA.
Corps of Engineers, Los Angeles, Calif.

Corps Eng Flood Plain Rep, Feb 1969. 33 p, 12 fig, 20 plate, 6 tab. Prepared for San Diego County.

Descriptors: *Floods, *Flood damage, *California, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: San Diego County (Cal), Standard project flood, Intermediate regional flood.

Flooding of the Sweetwater River, San Diego County, California is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-07716

FLOOD PLAIN INFORMATION OF CANY CREEK IN VICINITY OF JACKSON, MISSISSIPPI.
Corps of Engineers, Mobile, Ala.

Prepared for Jackson Planning Board. Corps Eng Flood Plain Rep, Feb 1969. 34 p, 6 fig, 11 plate, 10 tab.

Descriptors: *Floods, *Flood damage, *Mississippi, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Jackson (Miss), Standard project flood, Intermediate regional flood.

Flooding of Cany Creek, Jackson, Mississippi, is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-07717

FLOOD PLAIN INFORMATION OF MASON CREEK AT SALEM, VIRGINIA.
Corps of Engineers, Wilmington, N. C.

Prepared for Roanoke Valley Regional Planning Comm. Corps Eng Flood Plain Rep, Jan 1969. 28 p, 7 fig, 11 plate, 6 tab.

Descriptors: *Floods, *Flood damage, *Virginia, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Salem (Va), Standard project flood, Intermediate regional flood.

Flooding of Mason Creek, Salem, Virginia is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-07718

WATER RESOURCES DEVELOPMENT BY THE U. S. ARMY CORPS OF ENGINEERS IN SOUTH DAKOTA.
Corps of Engineers, Omaha, Nebr. Missouri River Div.

Corps Eng Water Resources Develop Rep, Jan 1969. 21 p, 8 photo, 1 map, index.

Descriptors: *Water management (Applied), *South Dakota, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U. S. Army Corps of Engineers projects (S Dak).

U. S. Army Corps of Engineers water resources development projects in South Dakota are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-07719

WATER RESOURCES DEVELOPMENT THE U. S. ARMY CORPS OF ENGINEER NORTH CAROLINA.
Corps of Engineers, Atlanta, Ga. South Atl Div.

Corps Eng Water Resources Develop Rep 1969. 79 p, 2 map, 32 photo, index.

Descriptors: *Water management (Appl *North Carolina, *Water resources develop Navigation, River basin development, Flood trol, Multiple-purpose projects, Hydroel power, Dams, River training.
Identifiers: U. S. Army Corps of Engineers pr (NC).

U. S. Army Corps of Engineers water reso development projects in North Carolina are l The role of the Corps of Engineers in planni building water resources improvement described briefly, and the procedure for initi such studies, authorization procedures, and of projects are outlined. Projects described in navigation, flood control, multiple-purpose jects, river surveys, erosion control, water su water pollution, power, recreation, and flood studies. (Knapp-USGS)
W69-07721

THEORY OF SEEPAGE FROM OPEN C NELS.
Agricultural Research Service, Phoenix, Water Conservation Lab.
For primary bibliographic entry see Field 02G.
W69-07725

TREND-SURFACE ANALYSIS OF THE B AND RANGE PROVINCE, AND S GEOMORPHIC IMPLICATIONS,
Geological Survey, Washington, D. C.
Lawrence K. Lustig.
Geol Surv Prof Pap 500-D, 1969. 70 p, 46 tab, 58 ref.

Descriptors: *Geomorphology, *Drainage pat (Geologic), Drainage density, River basins, sion, Geologic control, Hydrogeology, Sedime basins (Geological), Topography.
Identifiers: *Basin and Range province, Weste S.

An attempt is made to examine quantitativel existing regional topographic variations o Basin and Range province. The area of rang total area, range length, range width, range h range relief, range volume, cumulative leng trends, cumulative deviation of trends, range to length, range width to height, and range l to height are used for this purpose. Manual touring, relative-entropy function, Fourier ana and trend-surface analysis were used to an data. Relief ages are not identical with radiom dates because radiometric dates do not gen coincide precisely with dates of orogenic ac throughout the Basin and Range region. present regional topographic variations coi well with the known distribution of historic geologic tectonic events and with the distrib of Precambrian and lower Paleozoic outcro general, alluvial fans are more abundant in with large average values of range width, le height, relief, volume, and area of ranges to area, whereas pediments predominate in areas where these values diminish. Weath predominates on the steep mountain f whereas fluvial processes predominate in drainage basins. It is suggested that reg drainage distinctions are compatible with the graphic, relief age, and fan-pediment distinc because each is a function of time. The numbe drainage systems and their order numbers function of the range size in the absence of straints of shape and lithology. Drainage sy should accord with the steady state predicte stochastic models and by hydraulic principles older and smaller ranges of greater tectonic st

it may not yet have achieved this state within ounger and larger ranges. Trend-surface maps de a basis for examination of such drainage ctions within the Basin and Range province. pp-USGS)
-07730

OD PLAIN INFORMATION ON TIDAL DS AND COHANSEY RIVER IN CUMBER-D COUNTY, NEW JERSEY.
s of Engineers, Philadelphia, Pa.

s Eng Flood Plain Rep, Dec 1968. 61 p, 4 fig, e, 15 photo, 5 tab.

riptors: *Floods, *Flood damage, *New Jer-Flood plains, Flood control, Non-structural al-tives, Maximum probable flood.
ifiers: Cumberland County (NJ), Cohansey (NJ), Standard project flood, Intermediate nal flood.

ling of the tidal lands and Cohansey River, berland County, New Jersey is described in a t of flood plain problems based on records of all, runoff, and historical and present flood ts. Maps, photographs, profiles, and cross sec- indicate the extent of flooding that has oc-d and which may be expected to occur in the e. The information is for use in study and ing ways to minimize vulnerability to flood ges by control of flood plain use by zoning subdivision regulations, the construction of protection works, or by combinations of approaches. (Knapp-USGS)
-07739

OD PLAIN INFORMATION - TIDAL DS AND MAURICE RIVER CUMBERLAND NTY, NEW JERSEY.
s of Engineers, Philadelphia, Pa.

s Eng Flood Plain Rep, Dec 1968. 65 p, 16 fig, e, 6 tab.

riptors: *Floods, *Flood damage, *New Jer-Flood plains, Flood control, Non-structural al-tives, Maximum probable flood.
ifiers: Maurice River (NJ), Cumberland ty (NJ), Standard project flood, Intermediate nal flood.

ling of the Tidal lands and the Maurice River, berland County, New Jersey is described in a t of flood plain problems based on records of all, runoff, and historical and present flood ts. Maps, photographs, profiles, and cross sec- indicate the extent of flooding that has oc-d and which may be expected to occur in the e. The information is for use in study and ing ways to minimize vulnerability to flood ges by control of flood plain use by zoning subdivision regulations, the construction of protection works, or by combinations of approaches. (Knapp-USGS)
-07740

OD PLAIN INFORMATION-CHARLOTTE MECKLENBURG COUNTY-NORTH OLINA.
s of Engineers, Charleston, S. C.

ared for the Charlotte-Mecklenburg Planning m. Corps Eng Flood Plain Rep, Oct 1968. 53 fig, 42 plate, 9 tab.

riptors: *Floods, *Flood damage, *North lina, Flood plains, Flood control, Non-struc-alternatives, Maximum probable flood.
ifiers: Charlotte (NC), Mecklenburg County , Standard project flood, Intermediate re-l flood.

ding of the McAlpine and McMullen Creeks, lotte and Mecklenburg County, North lina is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-07741

DOWNSTREAM CHANGES IN SEDIMENTOLOGICAL PARAMETERS ILLUSTRATED BY PARTICLE DISTRIBUTION FROM A BREACHED ROCKFILL DAM,
Geological Survey, Sacramento, Calif.
For primary bibliographic entry see Field 02J.
W69-07754

THE EFFECT OF WATER DETENTION STRUCTURES ON RIVER AND DELTA MORPHOLOGY,
Colorado State Univ., Fort Collins, Dept. of Civil Engineering; and Agricultural Research Service, Fort Collins, Colo. Northern Plains Branch.
For primary bibliographic entry see Field 02J.
W69-07761

FLOOD PLAIN INFORMATION OF CHARLES RIVER, MEDWAY, MASSACHUSETTS,
Corps of Engineers, Waltham, Mass.

Corps Eng Flood Plain Rep, Aug 1967. 49 p, 10 plate, 13 photo, 4 tab, 32 ref. Prepared for the town of Medway.

Descriptors: *Floods, *Flood damage, *Massachusetts, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Charles River, Medway (Mass), Standard project flood, Intermediate regional flood.

Flooding of the Charles River, Medway, Massachusetts is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-07764

FLOOD PLAIN INFORMATION-MANATI RIVER, PUERTO RICO,
Corps of Engineers, Jacksonville, Fla.

Corps Eng Flood Plain Rep, Mar 1967. 31 p, 10 fig, 1 plate, 10 tab, 10 photo, 21 ref, 1 append. Prepared at the request of the Commonwealth of Puerto Rico.

Descriptors: *Floods, *Flood damage, Puerto Rico, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Manati River (Puerto Rico), Standard project flood, Intermediate regional flood.

Flooding of the Manati River, Puerto Rico is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-07765

MECHANICAL HARVESTING OF LAKE WEEDS APPEARS PROMISING FOR HALTING AGING PROCESS,
Wisconsin Univ., Madison. University-Industry Research Program.
For primary bibliographic entry see Field 02H.
W69-07815

DAMS AND LAKE WATER LEVELS.
For primary bibliographic entry see Field 06E.
W69-07883

DAMS AND LAKE WATER LEVELS.
For primary bibliographic entry see Field 06E.
W69-07884

LAKE WATER LEVELS.
For primary bibliographic entry see Field 06E.
W69-07885

WATER CONTROL WORKS AND WATER LEVELS.
For primary bibliographic entry see Field 06E.
W69-07886

NELSON V WILSON (SATURATION BY RAISING WATERTABLE CAN CONSTITUTE TAKING OF THE LAND).
For primary bibliographic entry see Field 06E.
W69-07896

DAMS IN DISREPAIR; ACQUISITION BY MUNICIPALITY.
For primary bibliographic entry see Field 06E.
W69-07897

DAMS.
For primary bibliographic entry see Field 06E.
W69-07905

FLOOD PLAIN INFORMATION, COTTONWOOD CREEK, GRAND PRAIRIE AND ARLINGTON, TEXAS.
Corps of Engineers, Fort Worth, Tex.

Corps Eng Flood Plain Rep, Mar 1969. 36 p, 4 fig, 12 plate, 11 tab.

Descriptors: *Floods, *Flood damage, *Texas, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Grand Prairie (Tex), Arlington (Tex), Standard project flood, Intermediate regional flood.

Flooding of Cottonwood Creek, Grand Prairie and Arlington, Texas is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-07929

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN TEXAS.
Corps of Engineers, Dallas, Tex. Southwestern Div.

Corps Eng Water Resources Develop Rep, Jan 1969. 64 p, 31 photo, 10 map, index.

Descriptors: *Water management (Applied), *Texas, *Water resources development, Navigation, River basin development, Flood control, Mul-

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tiple-purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U.S. Army Corps of Engineers projects (Tex).

U.S. Army Corps of Engineers water resources development projects in Texas are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-07934

WATER RESOURCES DEVELOPMENT IN MISSISSIPPI BY THE U.S. ARMY CORPS OF ENGINEERS.
Corps of Engineers, Vicksburg, Miss. Lower Mississippi Valley Div.

Corps Eng Water Resources Develop Rep, Jan 1969. 52 p, 3 fig, 51 photo, 4 map, index.

Descriptors: *Water management (Applied), *Mississippi, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U.S. Army Corps of Engineers projects (Miss).

U.S. Army Corps of Engineers water resources development projects in Mississippi are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-07935

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN TENNESSEE.
Corps of Engineers, Cincinnati, Ohio. Ohio River Div.

Corps Eng Water Resources Develop Rep, Jan 1969. 51 p, 22 photo, 3 map, index.

Descriptors: *Water management (Applied), *Tennessee, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U.S. Army Corps of Engineers projects (Tenn).

U.S. Army Corps of Engineers water resources development projects in Tennessee are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-07936

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN WEST VIRGINIA.
Corps of Engineers, Huntington, W. Va. Ohio River Div.

Corps Eng Water Resources Develop Rep, Jan 1969. 69 p, 22 photo, 1 map, 2 tab, index.

Descriptors: *Water management (Applied), *West Virginia, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U.S. Army Corps of Engineers projects (W Va).

U.S. Army Corps of Engineers water resources development projects in West Virginia are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-07937

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN SOUTH CAROLINA.
Corps of Engineers, Atlanta, Ga. South Atlantic Div.

Corps Eng Water Resources Develop Rep, Jan 1969. 45 p, 26 photo, 1 map, 2 tab, index.

Descriptors: *Water management (Applied), *South Carolina, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U.S. Army Corps of Engineers projects (SC).

U.S. Army Corps of Engineers water resources development projects in South Carolina are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-07938

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN WASHINGTON.
Corps of Engineers, Portland, Oreg. North Pacific Div.

Corps Eng Water Resources Develop Rep, Jan 1969. 100 p, 3 fig, 32 photo, 1 map, index.

Descriptors: *Water management (Applied), *Washington, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U.S. Army Corps of Engineers projects (Wash).

U.S. Army Corps of Engineers water resources development projects in Washington are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-07939

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN WYOMING.
Corps of Engineers, Omaha, Nebr. Missouri River Div.

Corps Eng Water Resources Develop Rep, 1969. 14 p, 4 fig, 6 photo, 1 map.

Descriptors: *Water management (Appli *Wyoming, *Water resources developm Navigation, River basin development, Flood trol, Multiple-purpose projects, Hydroele power, Dams, River training.
Identifiers: U.S. Army Corps of Engineers pro (Wyo).

U.S. Army Corps of Engineers water resou development projects in Wyoming are listed. role of the Corps of Engineers in planning building water resources improvements described briefly, and the procedure for initia such studies, authorization procedures, and st of projects are outlined. Projects described inc navigation, flood control, multiple-purpose jects, river surveys, erosion control, water su water pollution, power, recreation, and flood p studies. (Knapp-USGS)
W69-07940

DETERMINATION OF THE QUANTITY WATER TO BE STORED BY DIGITAL COM TERS,
Institute of Research of the Hydraulic Resou Budapest (Hungary).
J. Deri.
Symp on Use of Analog and Digital Compute Hydrol, Tucson, Ariz, Dec 1968, Int Ass Hydrol, Pub No 80, Vol 1, pp 152-160, 1968. 9 fig, 3 ref.

Descriptors: *Mathematical models, *Synth hydrology, *Digital computers, *Water utiliza *Water supply, Optimization, Systems anal Stochastic processes, Statistical models, W management (Applied), Risks, Forecasting.
Identifiers: Hungary.

Because both the water needs of water users the utilizable water resources are stochastic v bles, water needs can be satisfied only at a ce probability. The surplus and the shortage of w are also stochastic variables. By using the known methods of mathematical statistics quantity of water resources to be stored for users can be determined so that the expected nual operating costs including costs of the surpl and shortages would be the minimum. A meth introduced to determine the optimum w resources to be stored for the users if costs of unit quantities are not of stochastic chara After a comparison between the calculated an tually available reserves in every year a more tional utilization of water resources or directio the process of utilization will be possible. method can be applied to both simple and c plicated catchment areas. In simple cases problem can be solved manually, but in most c the application of digital computers is nee Digital computers may decisively contribute to development of the method of operations rese and activity analysis in the field of water man ment for the sake of better utilization of resou (Knapp-USGS)
W69-07960

FLOOD PLAIN INFORMATI CHICKAHOMINY RIVER WEST OF BOTTO BRIDGE, HENRICO COUNTY, VIRGINIA.
Corps of Engineers, Norfolk, Va.

Corps Eng Flood Plain Rep, Dec 1968. 35 p, 5 14 plate, 9 tab.

Descriptors: *Floods, *Flood damage, *Virg Flood plains, Flood control, Non-structural a natives, Maximum probable flood, Historic floo
Identifiers: Chickahominy River (Va), Hen County (Va), Standard project flood, Intermed regional flood.

Flooding of the Chickahominy River, Hen County, Virginia is described in a report of fl

problems based on records of rainfall, runoff, historical and present flood heights. Maps, ographs, profiles, and cross sections indicate xtent of flooding that has occurred and which be expected to occur in the future. The infor- on is for use in study and planning ways to mize vulnerability to flood damages by control od plain use by zoning and subdivision regula- , the construction of flood protection works, combinations of these approaches. (Knapp- S)
-07961

OD PLAIN INFORMATION, NEW RIVER, NEY, MILL, AND BLUE CREEKS, KSONVILLE, NORTH CAROLINA.
s of Engineers, Wilmington, N. C.

s Eng Flood Plain Rep, Dec 1968. 57 p, 14 fig, ate, 17 tab.

riptors: *Floods, *Flood damage, *North lina, Flood plains, Flood control, Non-struc- alternatives, Maximum probable flood, ric flood.
ifiers: Jacksonville (NC), Standard project , Intermediate regional flood.

ding in Jacksonville, North Carolina is ibed in a report of flood plain problems based ecords of rainfall, runoff, and historical and nt flood heights. Maps, photographs, profiles, cross sections indicate the extent of flooding has occurred and which may be expected to r in the future. The information is for use in and planning ways to minimize vulnerability od damages by control of flood plain use by g and subdivision regulations, the construc- of flood protection works, or by combinations ese appraoches. (Knapp-USGS)
-07962

OD PLAIN INFORMATION OF MUD ER IN VICINITY OF MILTON, WEST VIR- IA.
s of Engineers, Huntington, W. Va.

s Eng Flood Plain Rep, June 1968. 39 p, 15 6 plate, 7 tab.

riptors: *Floods, *Flood damage, *West Vir- , Flood plains, Flood control, Non-structural natives, Maximum probable flood, Historic .
ifiers: Milton (W Va), Standard project flood, mediate regional flood.

ding of the Mud River, Milton, West Virginia scribed in a report of flood plain problems d on records of rainfall, runoff, and historical present flood heights. Maps, photographs, les, and cross sections indicate the extent of ling that has occurred and which may be ex- ed to occur in the future. The information is se in study and planning ways to minimize vul- bility to flood damages by control of flood use by zoning and subdivision regulations, the truction of flood protection works, or by com- tions of these approaches. (Knapp-USGS)
-07963

OD PLAIN INFORMATION REPORT ON AWARE RIVER, BUCKS COUNTY, NSYLVANIA.
s of Engineers, Philadelphia, Pa.

s Eng Flood Plain Rep, July 1967. 60 p, 5 fig, te, 7 photo, 8 tab, append.

riptors: *Floods, *Flood damage, *Pennsyl- a, Flood plains, Flood control, Non-structural natives, Maximum probable flood, Historic .
ifiers: Delaware River, Bucks County (Pa), dard project flood, Intermediate regional d.

Flooding of the Delaware River, Bucks County, Pennsylvania is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-07975

STAGES AND DISCHARGES OF THE MISSISSIPPI RIVER AND TRIBUTARIES IN THE ST. LOUIS DISTRICT, 1965.
Corps of Engineers, St. Louis, Mo.

Corps Eng Basic Data Rep, 1966. 139 p, 1 map, 2 tab, index.

Descriptors: *Discharge (Water), *Mississippi River, *Data collections, *Missouri, Streamflow, Stage-discharge relations, Hydrologic data, Stream gages, Discharge measurement.
Identifiers: St. Louis (Mo).

The results of stage and discharge measurements made on the Mississippi River and its tributaries, principally in the St. Louis District, during the 1965 Calendar Year are tabulated. The data comprise a brief station description, a tabulation of daily stages and, where determined, mean daily discharges. A total of 95 stations are included. Data for 12 stations were furnished by other districts or other Government agencies. Twelve gages were established and 3 were discontinued during the year. The gage readings are water-surface elevations expressed in feet with reference to a zero elevation referred to mean sea level. The datum used is that of the 1929 General Adjustment. The time of gage readings is expressed in Central Standard Time. The river mileage as listed for each station on the Mississippi River is measured from the confluence of the Mississippi and Ohio Rivers; for tributary stations, from the mouth of the respective tributary. (Knapp-USGS)
W69-07988

THE INFLUENCE OF AQUATIC VEGETATION ON RIVER DISCHARGE,
State Inst. of Hydrology and Meteorology, Warsaw (Poland).
Zbigniew Pastawski.
Available from Clearinghouse as TT-67-56053 at $3.00 in paper copy. Wiad Sluzby Hydrol i Meorol, Vol 2, No 54, 1963. 39 p, 41 fig, 7 tab, 73 ref.

Descriptors: *Stage-discharge relations, *Aquatic plants, Channels, Discharge coefficients, Discharge (Water), River forecasting, Streamflow forecasting, Hydraulics, Hydrographs, Runoff, Stream erosion.
Identifiers: Poland.

The effects of aquatic vegetation on the stage-discharge relations of rivers is discussed. River plants regulate flow, prevent channel erosion, and facilitate ice-cover removal. European methods of calculating vegetation effect on river stages are reviewed. Results of correlation analyses of observations of Polish streams affected by vegetation are tabulated and shown graphically. (Knapp-USGS)
W69-07989

A STUDY OF THE SPECIFIC YIELD IN LAND-DRAINAGE SITUATIONS,
Agricultural Research Council, Cambridge (England). Unit of Soil Physics.
A. G. Dos Santos, Jr, and E. G. Youngs.
J Hydrol, Vol 8, No 1, pp 59-81, May 1969. 23 p, 11 fig, 24 ref.

Descriptors: *Specific yield, *Soil water, *Drainage, Gravitational water, Porosity, Permeability, Specific retention, Water storage, Percolation, Infiltration, Aquifers.
Identifiers: Soil air content.

From the definition of the specific yield in an unconfined aquifer, it is shown that the true specific yield is a function of the horizontal position and time and may be obtained from the measurements of localized fluxes and localized water-table movements. With the assumption of vertical flow above the water table, the specific yield is derived as the sum of the air content at the surface and the ratio of the rate of change of the volume of water held in the moisture profile above the water table to the rate of rise or fall of the water table. Since the latter ratio can be small in certain circumstances, the air content at the surface by itself is often a fair approximation to the specific yield. Results of measurements of all the specific yields, obtained in non-steady state drainage experiments using a completely permeable drain installation and a plastic drain installation in a hydraulic model sand tank, are presented. With the use of a virtual specific yield given by the air content at the surface in the midplane position between drain lines, calculated assuming steady state conditions with a stationary water table height and drain discharge for a given drain installation, rise and decay curves for the water table are calculated and compared with experiment, and fair agreement found. (Knapp-USGS)
W69-08005

A STOCHASTIC MODEL OF MONTHLY RESERVOIR STORAGE,
City Univ., London (England).
C. Venetis.
Water Resources Research, Vol 5, No 3, pp 729-734, June 1969. 6 p, 14 ref.

Descriptors: *Markov processes, *Stochastic processes, Reservoirs.
Identifiers: *Stochastic model, *Monthly reservoir storage, Autoregressive process, Markov Chain, Normality.

In this paper the reservoir inputs are assumed to be generated by a stochastic process. It is further assumed that the autoregressive process (continuous state space) can be adequately approximated by a finite Markov chain. The reservoir content will be treated as a finite Markov chain, conditional and nonhomogeneous. An expression giving the limiting distribution for each month is derived. It is noted that normality of the process is not essential to the model. A simple numeric example illustrates the application of the theory of monthly storage to practical problems. (Loeb-Rutgers)
W69-08062

ANALYSIS OF SMALL WATER MANAGEMENT STRUCTURES IN IRRIGATION DISTRIBUTION SYSTEMS,
Gaylord V. Skogerboe, Wynn R. Walker, Brent B. Hacking, and Lloyd H. Austin.
Research Project Summary Technical Completion Report WG-55-1, June, 1969. 38 p, 150 ref. Utah State University, Logan, Utah Water Research Laboratory. OWRR Project B-012-UTAH.

Descriptors: Hydraulic design, *Hydraulic structures, *Irrigation design, *Water distribution (Applied), Hydraulics, Irrigation engineering, Irrigation systems.

The Irrigation and Drainage Research Conference conducted at Utah State University (ASCE, 1964) delineated many of the research needs regarding 'Small Low-Cost Hydraulic Structures for Conveyance and Distribution Systems,' which was one of the six topics considered at the conference. In discussing possibilities for accomplishing the recommended research, it was suggested by some panel members that a considerable portion of the work could be undertaken by graduate students, particularly at the Master of Science level. The intent of this report has been to sort through the large volume of literature in an attempt to define the specific research needs regarding small water management structures used in irrigation distribu-

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tion systems. In particular, the emphasis has been to develop specific research topics which could be accomplished as a thesis by a graduate student at the Master of Science level.
W69-08117

DEVELOPMENT OF DRAINAGE ASSESSMENT PROCEDURES BASED ON PHYSICAL FEATURES IN ILLINOIS,
Illinois Univ., Urbana. Water Resources Center.
Benjamin A. Jones, Jr., and Carroll J. W. Drablos.
Research Report No 19, Water Resources Center, University of Illinois, May 1969, vi+ 27 p, 3 fig, 4 tab, 33 ref. OWRR Project A-011-ILL.

Descriptors: *Drainage, *Assessments, *Benefits, Drainage districts.
Identifiers: Physical features.

The objectives of this study were to identify the physical features of the land in a drainage district which influence benefits accruing from drainage improvements, and to formulate a method for distributing assessments based upon the relative importance of these physical features. The significant physical features discovered on the study were: (1) the distance from the tract of land to the main drain, (2) the distance from the tract of land to the main outlet, and (3) the permeability of the soil on the tract of land. An equation was developed to determine the assessment for any tract: An= 1.4845 - 0.3476 (Ln/L*) - 0.4680 (Dn/D*) 0.4434 Kn/K*). The equation provides a procedure to equitably distribute drainage assessments with a savings in time. This unbiased procedure should reduce the present objection of landowners of unfair assessments based upon personal judgment. Although the present equation is limited to the geographic area that supplied the data for the coefficients, the procedure developed may be used to calculate coefficients for other soil and morphological areas. (Betchart-Univ of Ill)
W69-08124

4B. Groundwater Management

NATURAL STORAGE TANKS USED TO REFILL THE THAMES RIVER,
Water and Sewage Works, Chicago Ill.
F. C. Livingstone.
Water and Sewage Works, Vol 116, No 6, pp 208-212, June 1969. 5 p, 4 fig, 1 tab.

Descriptors: *Low-flow augmentation, *Regulation, *Boreholes, Waste dilution, Water allocation (Policy), Water distribution (Applied), Groundwater, Water wells, Recharge, Water levels, Pumping, Water yield, Water storage, Storage tanks.
Identifiers: Thames River (England).

A plan is proposed to supplement the low flow of the Thames River, England with groundwater pumped from chalk beds in the Thames Basin. It is calculated that 340 mgd may safely be withdrawn from 248 wells, which can be drilled at a total cost of less than $20 million. The average annual rainfall in the Thames catchment is 28.84 inches, and in the period of record it has varied from 17.8 in. to 40.8 in. Annual runoff averages 9.6 in. Test holes and aquifer tests show that the amount of water available is enough to increase summer low flow to significantly reduce pollution, and groundwater levels will be lowered enough to increase winter wet period infiltration to greatly reduce high flows. (Knapp-USGS)
W69-07701

HYDROLOGIC CONDITIONS IN THE GILA BEND BASIN, MARICOPA COUNTY, ARIZONA,
Geological Survey, Phoenix, Ariz.
For primary bibliographic entry see Field 03F.
W69-07712

AN APPRAISAL OF THE GROUND-WATER RESOURCES OF THE SUSQUEHANNA RIVER BASIN IN NEW YORK STATE,
Geological Survey, Washington, D. C.
Este F. Hollyday.
Geol Surv Open-file Rep, Mar 1969. 52 p, 5 fig, 5 tab, 20 ref.

Descriptors: *Water resources, *Groundwater, *New York, Aquifers, Glacial drift, Water wells, Water quality, Water yield, Recharge, Water levels, Groundwater basins, Hydrogeology.
Identifiers: *Susquehanna River Basin (NY).

A survey was made of the groundwater resources of the Susquehanna River Basin in New York. The area's major aquifers are Pleistocence outwash. Yields are as high as 2,000 gpm at a cost of about 5 cents per 1000 gal. The quality of most water from the outwash is excellent. There is no present or foreseeable future water shortage in the basin; local problems may arise because of improper management or well locations. Some water from the bedrock contains excessive iron and chloride concentrations. A few samples of water from outwash contain too much iron, and all groundwater in the area is extremely hard. (Knapp-USGS)
W69-07713

GEOLOGY FOR LAND AND GROUND-WATER DEVELOPMENT IN WAYNE COUNTY, MICHIGAN,
Wayne State Univ., Detroit, Mich.
For primary bibliographic entry see Field 02F.
W69-07728

WATER IN KENTUCKY,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 03B.
W69-07943

CONFINED FRESH WATER AQUIFERS IN LIMESTONE EXPLOITED IN NORTH MEXICO WITH DEEP WELLS BELOW SEA LEVEL,
Office of Hydraulic Resources (Mexico).
For primary bibliographic entry see Field 02F.
W69-07981

THE APPLICATION OF ENGINEERING GEOLOGY IN THE REGIONAL DEVELOPMENT OF NORTHERN AND CENTRAL IRAN,
Imperial Coll. of Science and Technology, London (England). Dept. of Geology.
P. G. Fookes, and J. L. Knill.
Eng Geol, Vol 3, No 2, pp 81-120, Apr 1969. 40 p, 33 fig, 4 tab, 14 ref.

Descriptors: *Groundwater, *Water wells, *Aquifers, Alluvium, Tunnels, Groundwater basins, Water resources development, Water yield, Water levels.
Identifiers: *Iran, Qanats.

As in most arid environments, the availability and distribution of water in Iran has been the major factor in determining past regional development. The groundwater resources of the basins have been developed for a considerable period of time by the traditional, but very effective, systems of qanats. The futher exploitation of groundwater, therefore, requires careful evaluation of the manner in which modern methods of abstraction can be combined within existing patterns of usage. In those areas marginal to mountainous regions the integrated use of ground and surface water resources may be of considerable importance. Three case histories illustrate different facets of groundwater development in northern Iran grading from mountain to plain environments. In the more central areas, where qanats, tens of kilometers in length, are used to supply isolated desert villages, deep tube wells are replacing this ancient system because of their speed of construction and ease of maintenance. (Knapp-USGS)
W69-08009

4C. Effects on Water of Man's Non-Water Activities

WATER AND METROPOLITAN MAN,
American Society of Civil Engineers, Cam
Mass. Urban Hydrology Research Council.
For primary bibliographic entry see Field 06
W69-07722

COMPLIANCE WITH ARTICLE SUSP WHERE REQUIRED EQUIPMENT TAINABLE; ALLOWANCE FOR PLA AND INSTITUTING CHANGES.
For primary bibliographic entry see Field 06
W69-07879

CONSTRUCTION OF STATUTES REQU RAILROADS TO PROVIDE FOR DRAINAGE OR FLOW OF WATERS.
For primary bibliographic entry see Field 06
W69-07910

CONSTRUCTION OF STATUTES REQU RAILROADS TO PROVIDE FOR DRAINAGE OR FLOW OF WATERS.
For primary bibliographic entry see Field 06
W69-07911

CONSTRUCTION OF STATUTES REQU RAILROADS TO PROVIDE FOR DRAINAGE OR FLOW OF WATERS.
For primary bibliographic entry see Field 06
W69-07912

CONSTRUCTION OF STATUTES REQU RAILROADS TO PROVIDE FOR DRAINAGE OR FLOW OF WATERS.
For primary bibliographic entry see Field 06
W69-07913

CONSTRUCTION OF STATUTES REQU RAILROADS TO PROVIDE FOR DRAINAGE OR FLOW OF WATERS.
For primary bibliographic entry see Field 06
W69-07914

CONSTRUCTION OF STATUTES REQU RAILROADS TO PROVIDE FOR DRAINAGE OR FLOW OF WATERS.
For primary bibliographic entry see Field 06
W69-07915

APPLICATION OF AN ELECTRONIC A COMPUTER TO THE EVALUATION O EFFECTS OF URBANIZATION OF TH NOFF CHARACTERISTICS OF WATERSHEDS,
Utah Water Research Lab., Logan.
V. V. Dhruva Narayana, and J. Paul Riley.
Symp on Use of Analog and Digital Comp Hydrol Tucson, Ariz, Dec 1968, Int Ass Sci Pub No 80, Vol 1, pp 38-48, 1968. 11 p, tab, 5 ref.

Descriptors: *Analog computers, *Analog *Model studies, *Urbanization, *Rainfal relationships, Hydrographs, Hydrograph Storm runoff, Paving, Land use, Infiltration
Identifiers: *Urban hydrology, *Austin Waller Creek, Equivalent rural watershed.

In the synthesis of hydrograph character small urban watersheds, the distribution water among the various phases of the process is attempted by the concept of 'Eq Rural Watershed'. The criteria for transfor urban watershed into an equivalent rural w require that, for a given input into both the the outputs must be identical. The hydro

ow from an urban watershed is obtained by nologically deducting the losses due to inter-on, infiltration and depression storage from pitation on the equivalent rural watershed and routing it through the surface and channel ges. This is accomplished with the analog puter at the Utah Water Research Laboratory, State University at Logan. Testing and verifi-n is done with rainfall and runoff data from the er Creek watershed at Austin, Texas. In the cation process, coefficients representing in-ption, depression storage and infiltration are mined by trial and error so that the simulated graph is nearly identical to the measured graph of the prototype. The variation in the s of these coefficients from year to year is as-d to be due to the corresponding variations in haracteristics of urbanization defined by the ntage impervious cover and the characteristic vious length (ratio of the mean length of between the center of the impervious area he discharge measuring point to the maximum n of travel on the watershed. (Knapp-USGS) 07951

E ECONOMIC ASPECTS OF URBAN SEDI-TATION,
urces for the Future, Inc., Washington, D. C.
rt K. Davis, and David B. Brooks.
Economics, Vol. 43, No. 3, pp 312-319, Au-967. 8 p, 20 ref.

riptors: *Third party effects, *Sedimentation, development, Rural areas, Economics, Ac-ted erosion, Runoff, Sediment control, Strip .
ifiers: *Urban areas, Public control measures.

e effects of sedimentation violate a prime as-tion of the pure market system-that each mic actor is accountable for the con-nces of his own actions. The problem is con-d for both rural and urban areas. Urban sedi-ation presents a clear case of third party ef-It is largely caused by accelerated erosion (1) the vast exposure of raw soil at construc-ites, and (2) the extremely high peak runoff caused by the high proportion of roofed and land in urban watersheds. A large share of party losses are damaged recreational and tic values. Private economic incentives will lleviate the problem. There are major gaps in nowledge of the technical and economic ef-of public control measures, gaps that are criti-ot just for the design of efficient control ns but even for predicting whether sediment tion will improve or impair water quality. al alternative public actions are evaluated. procedures and regulations that coal strip s must follow in several states suggest an ap-h for urban land management. Land develop-should be compatible with the topography rainage system of a site. (Gossen-Chicago) 08110

Watershed Protection

MENTATION ENGINEERING CHAPTER ECONOMIC ASPECTS OF SEDIMENTA-,
as Maddock, Jr.
Amer Soc Civ Eng, J Hydraul Div, Vol 95, No pp 191-207, Jan 1969. 17 p, 30 ref, append.

riptors: *Sedimentation, Erosion, *Economic ct, Degradation, Beach erosion, *Deposition ments), Soil erosion, Sediments, Costs, ages, Estuaries, Alluvial channels, Stable nels, Bibliographies, Erosion control, ology, Turbidity, Navigation, Municipalities, rvoirs, Aggradation, Agricultural engineering. ifiers: Sediment-water relationship.

citation of problems connected with the ge of movement of water and sediment in m systems leads to the conclusion that these ems arise as a natural result of the change of the water-sediment regime. Costs of solving the problems should be considered in evaluating benefits occasioned by the original actions. Sometimes cause and effect relations are not understood by decision makers. A method of farming on flatland may be undesirable when applied to sloping ground. Diverting stormflow from city streets to natural watercourses may be harmful. Breaching a power dam filled with sediment will cause filling of channels downstream. Responsibilities of engineers studying the sedimentation problems involved in civil engineering works are threefold: (1) identifying the problem and forecasting the nonbeneficial effects of the solution; (2) designing projects with desirable purposes to mitigate the undesirable effects, and when this is not possible; (3) providing measures for controlling the undesirable reaction to an action for a desired purpose. The engineer is always confronted with the necessity of recognizing the entire problem, preparing a suitable plan for accomplishing a specific purpose, and assessing all costs involved in the plan. (USBR)
W69-07794

CARBONATE TURBIDITES, GULF OF MEXICO,
Texas A and M Univ., College Station. Dept. of Geology.
For primary bibliographic entry see Field 02J.
W69-07945

REWORKING OF GLACIAL SEDIMENTS IN THE NORTHWEST ARM, A FJORD-LIKE INLET OF THE SOUTHEAST COAST OF NOVA SCOTIA,
Smithsonian Institution, Washington, D. C. Div. of Sedimentology.
For primary bibliographic entry see Field 02J.
W69-07946

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

NUCLEAR METHODS IN AIR AND WATER POLLUTION ANALYSIS,
Louisiana State Univ., Baton Rouge.
Frank A. Iddings.
Environ Sci Technol, Vol 3, No 2, pp 132-140, Feb 1969. 9 p, 9 fig, 1 tab, 15 ref.

Descriptors: *Tracers, Radioactivity, *Radioactivity techniques, Air pollution, Radioactive decay, Radiochemical analysis, Radiochemistry, *Radioisotopes, Radiation measurement, *Chemical analysis, Chemistry, Gamma rays, Water analysis, Water pollution, Nuclear meters, Measuring instruments, Instrumentation, Quantitative analysis, Bibliographies.
Identifiers: *Radioactive tracers, Radionuclides, Radiation detectors, Nuclear radiation, Activation analysis.

Nuclear methods are well suited for air and water pollution analyses. Advantages are high sensitivity, specificity, relative freedom from interference, rapid and simple analysis, and low cost. Disadvantages include scarcity of trained technicians, adverse public reaction to nuclear methods, and availability of the proper tracer. Radioactivity and detection devices are summarized. Basic principles and applications are discussed for the following nuclear techniques: isotope dilution, radiorelease, radioisotope derivative analysis, radiometric titration, study of analytical chemistry methods, tracing, radiation absorption, and activation analysis. The brightest prospects for nuclear methods are in chemical analyses method studies and automation of analyses. Limited quantities of radioisotopes are available for studying analytical methods without a specific AEC license. General license quantities of radioactive isotopes are given. (USBR)
W69-07782

EVALUATION OF THE PYRIDINE-ALKALI COLORIMETRIC METHOD FOR DETERMINATION OF ATRAZINE,
Wisconsin Univ., Madison. Dept. of Soils.
R. O. Radke, D. E. Armstrong, and Gordon Chesters.
J Agr Food Chem, Vol 14, No 1, pp 70-73, Jan-Feb 1966. 2 fig, 3 tab, 10 ref. WP 00751-01.

Descriptors: *Colorimetry, *Analytical techniques, *Chemical analysis, *Herbicides, Degradation (Decomposition), Hydrogen ion concentration, Soil chemistry, Temperature, Water chemistry, Water pollution sources.
Identifiers: *Atrazine, Beer's law, 2-chloro-4-ethylamino-6-isopropylamino-s-triazine, 2-chloro-s-triazines, Hydroxtriazine, Perfusion, Propazine, Pyridine-alkali method, Pyridine-alkali-ethyl cyanoacetate method, Semazine.

An evaluation of the pyridine-alkali and pyridine-alkali-ethyl cyanoacetate techniques for the colorimetric determination of atrazine (2-chloro-4-ethylamino-6-isopropylamino-s-triazine) showed that color intensity was influenced by the pH of the system and temperature of reaction of the atrazine-pyridine complex with alkali. Color intensity increased with increased acidity and a suitable temperature for color development is 20 plus or minus 2 deg Celsius. The sensitivity of the pyridine-alkali-ethyl cyanoacetate method was 0.02 parts-per-million with a precision of plus or minus 1.5%. Either technique is adaptable to other 2-chloro-s-triazine herbicides. (Armstrong-Wisc)
W69-07821

THE PHYSIOLOGY OF THE COLIFORM GROUP,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Div. of Water Supply and Pollution Control.
Harold F. Clark, and Paul W. Kabler.
Proc Rudolfs Res Conf, Rutgers Univ, New Brunswick, NJ. Principles and Applications in Aquatic Microbiology, Heukelekian, H and Dondero, Norman C (eds), John Wiley and Sons, Inc, New York, pp 202-229, 1964. 1 fig, 2 tab, 52 ref, disc.

Descriptors: *Bacteria, *Coliforms, *Pollutants, Sanitary engineering, Water, Foods, Soils, Gases, Hydrogen, Carbon dioxide, Fermentation, Plants, Cattle, Grains (Crops), Biochemistry, Microorganisms, Milk, Acid bacteria, Carbohydrates, Physiochemical properties, Animals, Statistical methods, Birds, Human diseases, Sheep, Geographical regions, United States, Inspection, Spores, Hydrogen sulfide, E coli.
Identifiers: *Physiology, *Bacillus coli, Taxonomy, Health, Aerobacter aerogenes, Feces, Glucose, Morphology, Bacterium coli, Bacterium aerogenes, Motility, Coli communis, B lactes-aerogenes, Sucrose, Lactose, Dulcitol, Raffinose, Mannitol, Methyl, Indole, Tryptophan, Ehrlich reaction, Vibrio cholera, Pigs, Types, Acetylmethyl-carbinol, Citrate, Uric acid, Cellobiose, Liquefaction, Eijkman test.

Although the methodologies for distinguishing between the coliform strains of fecal and non-fecal origin are adequate for pollution, the perfect test has not been developed. The gas ratio (Hydrogen:Carbon dioxide) differential test seemed to solve the problem of differentiating the coliform bacteria of fecal origin from those of plant or soil origin but was unadaptable as a routine method. As laboratory procedure, the methyl red test was recommended as of equal value. Since certain assumptions were not valid, its use as a reference procedure was rejected. The property of producing indole from tryptophan has been extensively applied. The indole reaction by coliform bacteria from feces of warm-blooded animals is generally positive in excess of 90 percent, although approximately one-fifth of the coliform bacteria from unpolluted soils can also produce indole. The Voges-Proskauer test, traditionally used as a taxonomic characteristic, is useful in separating fecal from non-fecal coliform group when the data are interpreted statistically. The citrate utilization

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reaction is useful, on a statistical basis, for separating fecal and non-fecal types. The tests, methyl red, indole, Voges-Proskauer, citrate, none entirely satisfactory individually, combined (IMVIC test), yielded the best classification. The elevated temperature test was superior to other procedures in simplicity. (See Vol. 2, No. 18, Field 5C, W69-07423). (Jones-Wisc)
W69-07835

PROTISTS, PIGMENTS, AND PHOTOSYNTHESIS,
Brandeis Univ., Waltham, Mass. Dept. of Biology.
Jerome A. Schiff.
Proc Rudolfs Res Conf, Rutgers Univ, New Brunswick, NJ. Principles and Applications in Aquatic Microbiology, Heukelekian, H and Dondero, Norman C (eds), John Wiley and Sons, Inc, New York, pp 298-313, 1964. 5 fig, 2 tab, 14 ref, disc.

Descriptors: *Photosynthesis, *Pigments, *Chlorophyll, *Spectrophotometry, *Absorption, *Electron microscopy, Wavelengths, Sun, Light, Plant pigments, Electrochemistry, Plants, Animals, Microscopy, Algae, Thermodynamics, Energy, Ecology, Euglena.
Identifiers: *Protists, Protista, Monera, Chlorella, Scenedesmus, Chlamydomonas, Ulva, Spirogyra, Ochromonas, Nitzschia, Navicula, Coilodesme, Porphyridium, Porphyra, Hemiselmis, Cryptomonas, Cyanidium, Sennia, Tribonema, Monodus, Nitella, Chara, Gonyaulax, Anacystis, Chroococcus, Anabaena, Oscillatoria, Nostoc, Rhodospirillum, Chromatium, Rhodopseudomonas, Chlorobium, Chlorophyll a, Chlorophyll b, Chlorophyll c, Chlorophyll d, Carotenoids, Phycocyanin, Phycoerythrin, Chloroplasts.

Photosynthetic structures of higher plants and photosynthetic bacteria are compared chemically and with both light and electron microscopes. Higher plants, including Protista and Cyanophyta, evolve oxygen during photosynthesis, whereas photosynthesis in bacteria does not involve formation of molecular oxygen. Chlorophyll a has chemical ability to mediate photosynthesis by interacting with other enzymatic cell machinery. The resulting molecule represents a compromise between light-absorbing properties and chemical properties. Accessory pigments with absorption properties different from chlorophyll a, yield fluorescence characteristic of chlorophyll a, and permitting photosynthesis in limited spectrometric regions, increase the amount of energy. This is transferred along a chain of accessory pigments resulting, eventually, in chlorophyll a. Organisms occur ecologically according to their light-absorbing abilities. All photosynthetic organisms seem to have similar systems for the production of adenosine triphosphate and reduced triphosphopyridine nucleotide but differ in the way they obtain extra electrons. Green plants obtain these from a second photochemical reaction involving water, while with photosynthetic bacteria, they arise from externally added hydrogen sulfide, hydrogen, etc. Photosynthetic bacteria employ a somewhat different pigment from green plants, but the matabolic picture appears remarkably similar and the basic outlines are strongly suggested by the experimental data. (See also Vol. 2, No. 18, Field 5C, W69-07423). (Jones-Wisc)
W69-07836

THE METHANE FERMENTATION,
Stanford Univ., Calif. Dept. of Civil Engineering.
Perry L. McCarty.
Proc Rudolfs Res Conf, Rutgers Univ, New Brunswick, NJ. Principles and Applications in Aquatic Microbiology, Heukelekian, H and Dondero, Norman C (eds), John Wiley and Sons, New York, pp 314-343, 1964. 6 fig, 2 tab, 28 ref, disc.

Descriptors: *Bacteria, *Biochemistry, *Fermentation, *Methane, Acids, Amino acids, Anaerobic conditions, Carbohydrates, Carbon dioxide, Chemical oxygen demand, Chromatography, Decomposing organic matter, Lagoons, Lakes, Manometers, Microbiology, Ponds, Oxygen, Proteins, Sediments, Septic tanks, Sludge, Spores, Streams, Temperature, Tracers, Waste disposal, Yeasts.
Identifiers: Acetic acid, Clostridium, Methanobacterium formicicum, Methanobacterium proprionicum, Methanobacterium sohngenii, Methanobacillus omelianskii, Methococcus mazei, Methococcus vannielli, Methanosarcina barkerii, Methanosarcina methanica, Proprionic acid, Succinic acid.

Methane fermentation, conversion of organic matter to methane and carbon dioxide, was studied with impure or partially purified cultures. 'Acid formers' convert proteins, carbohydrate, and fats to fatty acids by hydrolysis and fermentation. Then methane-producing bacteria utilize the organic acids, converting them into carbon dioxide and methane. Rates of fermentation are dependent on optimum environmental conditions. Radiocarbon studies indicate that fatty acids are fermented by beta oxidation or a similar mechanism with the methane bacteria solely responsible. Fermentation of propionate may be a limiting factor in methane fermentation from fatty acids and carbohydrates. Tracer studies on overall methane fermentation of various carbohydrates indicate acetic acid formation and carbon dioxide reduction. Complex proteins were first hydrolyzed by bacterial enzymes into simple amino acids, then fermented by various pathways, depending upon the organisms involved. Free energy from methane fermentation of organics is low. Generation time required to double the bacterial population is related to minimum sludge retention time. If sludge retention time is decreased below generation time, bacteria will be wasted faster than they reproduce, resulting in failure of the process. It was found that yeast extract and certain other additions decreased the time required for gas formation. (See also Vol. 2, No. 18, Field 5C, W69-07423). (Jones-Wisc)
W69-07837

SOME ASPECTS OF THE BACTERIOLOGY OF THE RUMEN,
Agricultural Research Center, Beltsville, Md. Animal Husbandry Research Div.
Marvin P. Bryant.
Proc Rudolfs Res Conf, Rutgers Univ, New Brunswick, NJ. Principles and applications in Aquatic Microbiology, Heukelekian, H and Dondero, Norman C (eds), John Wiley and Sons, Inc, New York, pp 366-393, 1964. 1 fig, 2 tab, 116 ref, disc.

Descriptors: *Bacteria, *Ruminants, Fermentation, Enzymes, Microorganisms, Protozoa, Metabolism, Habitats, Biochemistry, Anaerobic bacteria, Carbohydrates, Cultures, Cellulose, Amino acids, Sludge.
Identifiers: *Rumen, Alimentary tract, Nutrition, Physiology, Fatty acids, Glycerol, Methanobacterium ruminantium, Veillonella alcallescens, Ruminococcus albus, Bacteroides amylophilus, Butyrivibrio fibrisolvens, Ruminococcus flavefaciens, Selenomonas ruminantium, Streptococcus bovis, Bacteroides ruminocola, Bacteroides succinogenes, Peptostreptococcus elsdenii, Lachnospira multiparus, Succinovibrio dextrinosolvens, Eubacterium ruminantium, Borrelia, Anaerobic lactobacilli, Xylan, Starch, Lactate.

Differing from most bacteria in other natural habitats, rumen bacteria are significant in comparative biochemistry and nutrition. Primarily they ferment carbohydrates; also, they absorb volatile fatty acids as their energy source and hydrolyze protein to amino acids and peptides. Rumen fluid agar media with small amounts of certain carbohydrates were most successful for species culture and colony counts. They are mainly nonsporeforming anaerobes, isolated only from the rumen. Similar species occur in sediments of natural waters and sewage sludge. These differ in that methane is formed in sludge but not in the rumen. The 'rumen fluid' factor required by many cellulolytic bacteria seems to consist of a two-component requirement for volatile fatty acids sti
tory to cellulose digestion and protein syn
under certain conditions. These acids, import
metabolism, may be required. Certain tetrapy
appear to be required mainly for synthesis
cytochrome of the b type. The nitrogen re
ments of many rumen bacteria are quite un
compared to those of heterotrophic bacteria
studied. Most species can be grown with amm
as the main source of nitrogen. Some s
require amino acids; others not. Some species
to utilize ammonia for growth in preference
ganic nitrogen. (See also Vol. 2, No. 18, Fiel
W69-07423) (Jones-Wisc)
W69-07839

PHYSIOLOGY OF THE RUMEN PROTOZO
Agricultural Research Center, Beltsville,
Animal Husbandry Research Div.
J. Gutierrez, and R. E. Davis.
Proc Rudolfs Res Conf, Rutgers Univ, New
swick, NJ. Principles and Applications in Ac
Microbiology, Heukelekian, H and Dondero,
man C (eds), John Wiley and Sons, Inc, pp
404, 1964. 2 fig, 1 tab, 17 ref, disc.

Descriptors: *Ruminants, *Protozoa, *Bac
Cattle, Reproduction, Metabolism, Amino
Tracers, Proteins, Chromatography, Ferment
Digestion, Lipids, Manometers, Streptococcu
falfa.
Identifiers: *Rumen, *Physiology, C
Isotrichs, Holotrichs, Paramecium, Iso
prostoma, Isotricha intestinalis, Dasyt
Diplodinium ecaudatum, Entodinium sim
Ophryoscolex caudatus, Starch, Epidinium
datum, Diplococcus, Peptostreptococcus.

Some functions carried out by rumen protozo
producing fatty acids which are absorbed yi
energy to the host; aiding digestion of ingeste
strates--starch, cellulose, and bacteria; servin
source of protein for the host. Tracer experi
showed they are able to incorporate amino
As a source of protein, the protozoa furnishe
of the host requirement. Protozoan protei
found to have a higher nutritive value than ba
al or yeast protein. Protein contributed to th
was calculated for several protozoa with the
lar nitrogen content experiments. Paper
matography of acid-hydrolyzed suspensions h
dicated a long list of amino acids contained
protozoal protein, available to the host. The
titative experiments on ammonia production
casein show that, for some rumen protozoa
monia can be an important product of nit
metabolism. They contribute to lipid metaboli
the rumen. All the common genera of protozo
bacteria feeders. Protozoan requirement
growth were studied by in vitro culture wor
the several media developed, ground rice stare
falfa, and Streptococcus bovis, made a succ
medium. Attempts to grow the protozoa wi
living bacteria have been unsuccessful. (Se
Vol. 2, No. 18, Field 5C, W69-07423) (J
Wisc)
W69-07840

**MICROBIAL TRANSFORMATIONS OF S
ORGANIC SULFUR COMPOUNDS,**
Rutgers - The State Univ., New Brunswick,
Dept. of Agricultural Microbiology.
Robert L. Starkey.
Proc Rudolfs Res Conf, Rutgers Univ, New
swick, NJ. Principles and Applications in Ac
Microbiology, Heukelekian, H and Dondero,
man C (eds), John Wiley and Sons, Inc, New
pp 405-429, 1964. 5 fig, 2 tab, 70 ref, disc.

Descriptors: *Sulfur, *Microorganisms, *O
compounds, Detergents, Plants, Animals, Ind
raw materials, Proteins, Amino acids, Bac
Yeasts, Enzymes, Spores, Soils, Actinomy
Fungi, Ammonia, Nitrogen, Decomposing o
matter, E coli.
Identifiers: Alcaligenes metalcaligenes, Alcal
faecalis, Aspergillus niger, Penicillium, Cla

urea, Proteun vulgaris, Streptococcus lactis genes, Proprionibacterium pentosaceum, Clos- m sporogenes, Clostridium tetanomorphum, ridium perfringens. Achromobacter novorum, Pseudomonas aeruginosa, Fungi im- cti, Schizophyllum commune, Scopulariopsis caulis, Microsporeum gypseum, Shigella flex- Dissimilation, Interconversion.

nic sulfur compounds show marked dif- ces in susceptibility to microbial attack. tases of bacteria, fungi, and animal and plant bring about the cleavage which results in uction of sulfate by hydrolysis. Dissimilation of ne and cysteic acid by fungi, bacteria, and ac- nycetes resulted first in release of nitrogen as onia and sulfur as sulfite, then oxidized to te. Dissimilation of cyst (e)ine produces sul- also elemental sulfur and sulfate. In decom- ion, although sulfur in the cysteine is in a ced state, the inorganic sulfur product need e a highly reduced compound. Only one initial kdown product from methionine consistently rted is methyl thiol. Cultures grown in a simple ral salts medium containing methionine as the organic substance were all similar, Gram- tive, non-sporulating bacteria. The only ucts formed were methyl thiol and dimethyl fide. Aspergillus sp gave results similar to of the bacteria, differing in that it did not in a medium with methionine the only organic rial. Interconversion of methionine and ine has been established. Although the organisms may be able to fulfill their require- s for each amino acid from the other, the dis- lation reactions proceed without any change e other amino acid. (See also Vol. 2, No. 18, 5C, W69-07423).
-07841

DIALYSTAT: NEW SAMPLER FOR DIS- VED ORGANIC MATTER,
nington Univ., St. Louis, Mo. Dept. of Botany.
e C. Parker.
nology and Oceanography, Vol 13, No 4, pp 723, Oct 1967. 1 fig.

riptors: *Organic matter, *Sampling, Analyti- echniques, Aquatic environments, Dialysis, r chemistry, Water pollution sources.
ifiers: *Dissolved organic matter, *Biodialy- Cyanocobalamine, Millipore filters.

biodialystat is a device for collection of cell- water for its content analysis of dissolved or- matter. The sampler is essentially a chamber h is placed in situ and which functions by per- ng dialysis of ambient natural water against ized distilled water contained in the chamber. librium time must be standardized for each ound of interest. Cobalamine, for which or has used the biodialystat, reaches maximum entration after 24-36 hours in lake water at 0 degrees C. Tested with millipore membrane e diameter 0.2 micron) in sewage sludge, plankton cultures, and lake water, device ined impervious to microorganisms for at least days. Author lists following advantages for ler: eliminates local chemical differences in tic environments; eliminates need for protec- of samples against biological changes between ction and analysis; eliminates errors due to tions in method for removal of seston; uces more reliable estimates of dissolved sub- ces than do filtration methods. A bill of materi- nd a photograph of the device is included in eport. (Eichhorn-Wisc)
-07865

LORINATED HYDROCARBON PESTICIDES ALIFORNIA BAYS AND ESTUARIES,
ornia State Dept. of Fish and Game, Menlo . Marine Resources Operations.
primary bibliographic entry see Field 05B.
-07920

THE INFLUENCE OF SALTS APPLIED TO HIGHWAYS ON THE LEVELS OF SODIUM AND CHLORIDE IONS PRESENT IN WATER AND SOIL SAMPLES,
Maine Univ., Orono. Dept. of Plant and Soil Sciences.
Frederick E. Hutchinson.
Maine Univ Project Completion Report, June, 1969. 18 p, 9 tab, 2 fig, 6 ref. OWRR Project A-007-ME.

Descriptors: Pollutant identification, *Saline soils, Soil-water relationships, Chlorides, Impaired water quality.

This research project was conducted to determine the effect of salt application to de-ice highways on the sodium and chloride levels in (1) streams and rivers, (2) private water supplies contiguous to highways and (3) soils bordering highways. Analyses of seven rivers in Maine from six samplings over a two-year period indicate that sodium and chloride concentrations are not affected by highway salting; since the level of both ions remained consistent throughout the period. Although the concentrations of both ions tended to increase from the headwaters to the mouth of the rivers, the average concentrations for 27 sites were 3.4 and 1.5 ppm for sodium and chloride, respectively. Semiannual analyses of 100 randomly selected wells along Maine highways indicate that levels of sodium and chloride are much higher than normal, averaging 69 and 162 ppm, respectively. Twenty-five percent of the wells were unfit for potable supplies because they contained in excess of 250 ppm of chloride. Sodium and chloride levels in soils contiguous to highways bear a direct relationship to the length of time over which highways have been salted. In areas where salt has been applied for 20 years the sodium levels have risen over a distance of 60 feet from the edge of the highway and to a depth of 18 inches. Sodium saturation of the soil approaches 15% at some sites, and chloride levels in the soilwater system ranged from 10 to 2525 ppm, thereby producing the equivalent of an 'alkali' condition.
W69-08120

5B. Sources of Pollution

REDUCTION OF RIVER HEAT POLLUTION BY TURBULENCE STIMULATION,
Sacramento State Coll., Calif. Dept. of Civil Engineering; and Connecticut Univ., Storrs. Dept of Civil Engineering.
Alan L. Prasuhn, and Victor E. Scottron.
Conn Univ School Eng Rep No 69-22, May 1969. 17 p, 6 fig, 23 ref. OWRR Proj No A-011-CONN.

Descriptors: *Thermal pollution, *Water pollution control, *Turbulence, *Mixing, Dispersion, Diffusion, Water temperature, Surface waters, Streamflow, Mathematical models.
Identifiers: Turbulence stimulation.

A wind tunnel study was made of a two-dimensional, heat stratified flow. A mathematical model was developed and compared with measured temperature profiles for flow over both smooth and rough boundaries. Increased turbulence greatly accelerated the mixing rates. The possibility is suggested that artifically induced turbulence might enhance mixing and stream temperature control. (Knapp-USGS)
W69-07702

CHEMICAL EQUILIBRIA AND ZONING OF SUBSURFACE WATER FROM JACHYMOV ORE DEPOSIT, CZECHOSLOVAKIA,
Geological Survey of Czechoslovakia, Prague.
For primary bibliographic entry see Field 05G.
W69-07703

OCCURRENCE AND SIGNIFICANCE OF PESTICIDE RESIDUES IN WATER,
Federal Water Pollution Control Administration, Athens, Ga. Southeast Water Lab.
For primary bibliographic entry see Field 05G.
W69-07704

A SURVEY OF HEAT SINK CAPACITY OF MAJOR STREAMS WITHIN THE U. S.,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
K. R. Wise, and B. M. Cole.
Battelle Mem Inst Pacific Northwest Lab Rep No 951, Jan 1969. 61 p, 2 fig, 2 tab, 8 ref, 2 append.

Descriptors: *Cooling water, *Thermal powerplants, *Streamflow, Water temperature, Surveys, Water quality control, Water quality act, Regulation, Water pollution control, United States.
Identifiers: Streamflow-temperature surveys, Water quality standards.

Data are presented indicative of the limitations of the cooling water supply in the nation. As an index of cooling potential for each major stream, heat input for a 1 deg F temperature rise, with the minimum monthly average flow recorded in a 10 yr period, is used. Based on this characteristic of the streams in the U.S. locations are identified on a regional basis, where alternative solutions to once-through cooling can be anticipated first. Water quality standards will also affect cooling water availability and an attempt is made to identify the potential impact of these standards. (Knapp-USGS)
W69-07720

A TEST SIMULATION OF POTENTIAL EFFECTS OF THERMAL POWER PLANTS ON STREAMS IN THE UPPER MISSISSIPPI RIVER BASIN,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
D. E. Peterson, and R. T. Jaske.
Battelle Mem Inst Pacific Northwest Lab Rep No 999, Dec 1968. 75 p, 23 fig, 3 tab, 32 ref, append. Contract No AT (45-1)-1830 AEC.

Descriptors: *Thermal pollution, *Thermal powerplants, *Mississippi River, *Mathematical models, *Systems analysis, Simulation analysis, Digital computers, Computer programs, Model studies, Mississippi River Basin.
Identifiers: Heat discharge model.

The 1964 thermal regimens of the Upper Mississippi River and 8 major tributary streams were simulated with the COL HEAT digital model. The potential impact of 1980 and year 2000 power requirements were simulated under the assumption of flow-through cooling of steam generating plants. The results indicate that by the year 2000 few, if any, plant sites will remain along the Mississippi River where flow-through cooling can be exclusively utilized for 1,000 MW units. (Knapp-USGS)
W69-07738

USE OF ANALOG COMPUTERS FOR SIMULATING THE MOVEMENT OF ISOTOPES IN ECOLOGICAL SYSTEMS,
Vanderbilt Univ., Nashville, Tenn. Graduate School.
R. B. Neel, and J. S. Olson.
Available from Clearinghouse as ORNL 3172 at $3.00 in paper copy and $0.65 in microfiche. W-7405-eng-26. ORNL-3172. US AEC, Oak Ridge Nat Lab, Oak Ridge, Tenn. 120 p. 24 fig, 3 tab, 21 ref.

Descriptors: *Simulation analysis, *Analog models, *Analog computers, *Ecosystems, *Carbon cycle, Carbon radioisotopes, Computer models, Radioecology.
Identifiers: *Analog computer simulation, Compartment models, Environmental radioactivity, Analog computer techniques.

Analog computers may be used to simulate movements of stable carbon and carbon-14 between compartments in ecosystem models. Simulation is achieved through solution of appropriate systems

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of linear differential equations. When an analog model representing a four-compartment terrestrial ecosystem is used to describe the build-up and movement of carbon in the system, a series of linear lags in the approach of each compartment toward a steady state is observed. Similar results are obtained for carbon-14. However, analog techniques need not be restricted to simple ecosystem simulation. The same methods and combinations of analog computer components can be used for either simple or complex ecosystems. By considering more detailed compartment models and describing ecosystems with either linear (including variable-coefficient) or non-linear systems of differential equations, very complex ecosystems can be examined in detail. (Huff-Wisc)
W69-07819

TRACER STUDY OF THE PHOSPHORUS CYCLE IN SEA WATER,
Dalhousie Univ., Halifax (Nova Scotia). Inst. of Oceanography.
W. D. Watt, and F. R. Hayes.
Limnol Oceanogr, Vol 8, pp 276-285, 1963. 8 fig, 3 tab, 18 ref, disc.

Descriptors: *Cycling nutrients, *Phosphorus compounds, *Sea water, *Tracers, Bacteria, Chromatography, Cyanophyta, Diatoms, Decomposing organic matter, Ecosystems, Enzymes, Equilibrium, Eutrophication, Lakes, Phosphorus radioisotopes, Plankton, Water chemistry, Water pollution effects, Water pollution sources, Zooplankton.
Identifiers: *Phosphorus cycle, Comparative studies, Daphnia magna, Dynamic equilibria, Dissolved inorganic phosphorus, Fucus vesiculosus, Gammarus, Halifax, Nova Scotia, Millipore filtration, Nostoc, Paper chromatography, Particulate phosphorus, Phosphatases, Skeltonema, Turnover times.

The biological exchange of phosphorus between dissolved inorganic phosphorus (DIP), particulate phosphorus (PP) and dissolved organic phosphorus (DOP) fractions was studied by adding DIP-32 to sea water and following the amounts of P-32 in each of the three fractions with lime, steady-state conditions were assured. A rapid decline in DIP-32, a rapid increase in PP-32 and a relatively slow increase in DOP-32 were observed. The main exchange processes were concluded to be DIP with PP and PP with DOP. Because addition of DOP-32 to sea water resulted in more rapid accumulation of PP-32 than DIP-32, direct conversion of DOP to DIP was believed not to occur. Exchange rates (micrograms-atoms P/liter/day) measured in coastal water from near Halifax, N S, Canada, were 0.23 between DIP and PP and 1.2 between PP and DOP. Amounts of P in the DIP, PP and DOP fractions for this site were 0.35, 2.98, and 0.60 micrograms-atoms P/liter, respectively. The DOP-32 fractions were resolved by paper chromatography into six components. (Armstrong-Wisc)
W69-07822

EFFECT OF HANFORD REACTOR SHUTDOWN ON COLUMBIA RIVER BIOTA,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
For primary bibliographic entry see Field 05C.
W69-07853

SOIL DEGRADATION OF DIAZINON, A PHOSPHOROTHIOATE INSECTICIDE,
Wisconsin Univ., Madison. Dept. of Soils.
J. G. Konrad, D. E. Armstrong, and G. Chesters.
Agronomy J, Vol 59, pp 591-594, Nov-Dec 1967. 3 fig, 3 tab, 10 ref.

Descriptors: *Degradation (Decomposition), *Insecticides, *Diazinon, *Phosphorothioate pesticides, *Soil chemistry, Adsorption, Hydrolysis, Water pollution sources, Soil contamination, Pesticide residues, Organic matter, Hydrogen ion concentration, Wisconsin, Toxicity.
Identifiers: 2-isopropyl-4 methyl-6 hydroxypyrimidine, Diethyl thiophosphoric acid, Poygan sicl soil, Kewaunee c soil, Ella 1s soil.

Degradation of the insecticide diazinon was followed in acid soil-free systems and in soil systems. The mechanism of diazinon degradation in soils is a partial chemical hydrolysis with formation of 2-isopropyl-4-methyl-6-hydroxypyrimidine and diethyl thiophosphoric acid; hydrolysis in soils is adsorption catalyzed rather than acid catalyzed. Degradation rates were 11, 7, and 6% per day for three Wisconsin soils: Poygan sicl, Kewaunee c, and Ella 1s, respectively; these rates were related to organic matter content and pH of the soil. (Konrad-Wisc)
W69-07867

COMPLIANCE WITH ARTICLE SUSPENDED WHERE REQUIRED EQUIPMENT UNOBTAINABLE; ALLOWANCE FOR PLANNING AND INSTITUTING CHANGES.
For primary bibliographic entry see Field 06E.
W69-07879

CHLORINATED HYDROCARBON PESTICIDES IN CALIFORNIA BAYS AND ESTUARIES,
California State Dept. of Fish and Game, Menlo Park. Marine Resources Operations.
John C. Modin.
Pesticides Monit J, Vol 3, No 1, pp 1-7, June 1969. 7 p, 1 fig, 6 tab, 7 ref.

Descriptors: *Pesticide residues, *Estuaries, *California, *Fish, Pollutants, DDT, Chlorinated hydrocarbon pesticides, Pesticide kinetics, Water pollution sources, Monitoring, Data collections.
Identifiers: DDD, DDE.

As part of a nationwide program to monitor organochlorine pesticide residues in estuaries, the U. S. Bureau of Commercial Fisheries in January 1966 contracted to the California Department of Fish and Game the responsibility to monitor selected estuaries in California for pesticides. Analyses of oysters, mussles, and clams sampled at points of interest within each estuary revealed DDT, DDD, DDE, dieldrin, and endrin in concentrations from 10 to 3,600 ppb. Calculations are based on the laboratory wet weight of homogenized tissue. In studies of offshore exposure, high levels of DDT, DDD, and DDE were found in a king crab (2,739 ppb) and in ova from a king salmon (668 ppb). Pesticides were also measured in the ova of prawn, flounder, halibut, and sole; of these, halibut ova were the most highly contaminated, with DDE, DDD, and DDT measuring 591 ppb. (Knapp-USGS)
W69-07920

PESTICIDE RESIDUES IN SEDIMENTS OF THE LOWER MISSISSIPPI RIVER AND ITS TRIBUTARIES,
National Communicable Disease, Atlanta, Ga.; Food and Drug Administration, Washington, D. C.; Agricultural Research Service, Oxford, Miss. Sedimentation Lab.; and Agricultural Research Service, Gulfport, Miss. Plant Pest Control Div.
W. F. Barthel, J. C. Hawthorne, J. H. Ford, G. C. Bolton, and L. L. McDowell.
Pesticides Monit J, Vol 3, No 1, pp 8-66, June 1969. 58 p, 5 fig, 31 maps, 9 tab, 2 ref.

Descriptors: *Pesticide residues, *Mississippi River, *Sediments, Silts, Sands, Clays, Pollutants, DDT, Dieldrin, Aldrin, Endrin, Heptachlor, Chlorinated hydrocarbon pesticides, Pesticide kinetics, Water pollution sources, Monitoring, Data collections.
Identifiers: Lower Mississippi River Basin.

Studies of the chlorinated hydrocarbon content of sediments and water from the lower Mississippi River and its tributaries were conducted in 1964, 1966, and 1967 to determine the extent and possible sources of agricultural pesticides in the streams of the Delta. The Mississippi River bed was pled at 11 sites located between Tiptonville, and New Orleans, La. Tributaries of the Miss in the Delta were sampled in Tennessee, Mis pi, Louisiana, and Arkansas. Pesticides re were detected from both agricultural nonagricultural sources: however, no evidenc found of a general buildup of chlorinated hyd bons in the sediments of these streams from use. Diedrin, aldrin, endrin, endrin keto, is chlordane, heptachlor, hexachlorononborna and heptachlorononborbene were found in ment and water samples collected from C Creek and Wolf River at Memphis, Tenn., primary manufacturer of endrin and hepta Lower concentrations of several of these pounds were detected in sediments collected tributary streams in Mississippi near formu plants that prepare the technical pesticid agricultural use. DDT analogs and metal were found in some of the tributary streams no known formulators are located. (Knapp-U
W69-07921

RECONNAISSANCE OF THE CHEM QUALITY OF SURFACE WATERS OF THI ANTONIO RIVER BASIN, TEXAS,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 02K
W69-07927

HYDROLOGIC DATA: 1967, VOLUM SOUTHERN CALIFORNIA,
California State Dept. of Water Resources, mento.
For primary bibliographic entry see Field 02E
W69-07933

NATIONAL REFERENCE LIST OF W QUALITY STATIONS, WATER YEAR 196
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 05C
W69-07941

ANIMAL WASTES--A NATIONAL PROBL
Cornell Univ., Ithaca, N. Y. Dept. of Agric and Cornell Univ., Ithaca, N. Y. Dept. of Ci gineering.
Raymond C. Loehr.
ASCE Proc, J Sanit Eng Div, Vol 95, No SA 6493, pp 189-221, Apr 1969. 33 p, 4 fig, 9 t ref. Contract No 14-12-88 FWPCA.

Descriptors: *Water pollution sources, *Wat lution control, *Farm wastes, *Confinement *Reviews, Bibliographies, Waste treat Sewage treatment, Farm lagoons.
Identifiers: Animal waste problems.

A state of the art summary is given of the c and management of animal wastes. Items sidered include the magnitude of the problem lution that has been caused by animal wastes. ble treatment processes, major problem area areas for future activity. The problems curren sociated with the handling, treatment, and di of animal wastes will be magnified in the futu timate disposal techniques for untreated solids and liquids as well as the residues from treatment processes should be integrated feasible handling and treatment process develop suitable waste control and abat systems. Large-scale animal production fa should be considered as individual indu responsible for pollution abatement. (K USGS)
W69-08010

RURAL RUNOFF AS A FACTOR IN STR POLLUTION,
Robert A. Taft Sanitary Engineering Center cinnati, Ohio. Cincinnati Water Research Lab R. B. Weidner, A. G. Christianson, and S. R. Weibel.

ter Pollut Contr Federation, Vol 41, No 3, , pp 377-384, Mar 1969. 8 p, 6 fig, 10 tab, 3

iptors: *Water pollution sources, *Runoff, ns, *Farm wastes, Bacteria, Biochemical ox- demand, *Erosion, Phosphates, Nitrogen ounds, Sediments.
ifiers: Rural runoff.

ropped and mixed agricultural watersheds experimental prevailing and improved crop management at Coshocton, Ohio, and an orchard over meadow at Ripley, Ohio, were mented to sample and gage rainfall and storm f from the fields. Under prevailing practices hly volume of runoff from fields was higher hat under improved practices such as contour ng and strip cropping. More runoff developed a field in corn than from one in wheat, and the runoff developed from fields in meadow. correlations between rural runoff silt losses otal solids, and between total solids and BOD, total hydrolyzable phosphate, and total gen were found. Microbial tests showed that acterial sources were predominantly nonhu- but total coliforms exceeded 1,000/100 ml in of the samples in runoff from 2 of the rural sheds. (Knapp-USGS)
-08013

SPILLAGE PREVENTION, CONTROL, RESTORATION-STATE OF THE ART RESEARCH NEEDS,
lle Memorial Inst., Richland, Wash.; and onautics, Inc., Laurel, Md.
rimary bibliographic entry see Field 05G.
-08014

E GAS COMPOSITION UNDER SEWAGE ADING,
rt A. Taft Santiary Engineering Center, Cin- ti, Ohio. Cincinnati Water Research Lab.
Thomas, W. A. Schwartz, and T. W. ixen.
Sci Soc Amer Proc, Vol 32, No 3, pp 419-423, June 1968. 5 p, 4 fig, 16 ref.

riptors: *Sewage disposal, *Water spreading, ration, *Aerobic treatment, Water pollution ts, Septic tanks, Lysimeters, Oxygen, Carbon de, Microorganisms.
ifiers: Pore gas, Pore clogging.

c tank effluent was applied to sand in labora- lysimeters. Dosing frequencies of 2/day and were used to observe relationships between ges in the composition of the pore gas and the ing of the sand. The rate of clogging in the unit was less than that in the 6/day unit. This ced rate of clogging was related to pore-gas moisture content changes which occurred in ewage dosing and drainage cycles. The longer of the 2/day frequency provided more oxygen a greater percentage of the total elapsed time. e 6/day lysimeter the rapid soil clogging, which aracteristic for anaerobic conditions, started the oxygen concentration in the pore gas was er than 13 percent. Water-filled pores or r films, occurring as the result of an increase in oisture content, may have provided anaerobic in the presence of the high pore-gas oxygen. on dioxide inhibition of microbial growth did ause the rapid phase of clogging. Moisture or en determinations may be suitable guides for ention of the rapid phase of soil clogging. (K- -USGS)
-08027

ORINATED INSECTICIDES IN RUNOFF TER AS AFFECTED BY CROP ROTATION,
cultural Research Service, Orono, Maine. t. of Plant and Soil Science; and Maine Univ., no. Water Resources Center.
pstein, and W. J. Grant.
Sci Soc Amer Proc, Vol 32, No 3, pp 423-426, -June 1968. 4 p, 6 tab, 20 ref.

Descriptors: *Pesticides, *Runoff, *Rotations, Water pollution sources, Path of pollutants, DDT, Endrin, Gas chromatography.
Identifiers: Crop rotation effects.

The concentration and amounts of 3 chlorinated insecticides were lower in runoff from a rotation system of potato, oats, and sod, than under continuous potato cropping. Runoff samples from natural runoff plots were collected following each storm, and the amounts of DDT, endrin, and endosulfan were analyzed with a gas chromatograph. The amounts of pesticides in runoff were small compared to the amount applied. The concentrations of the insecticides in the runoff (soil-water suspension) were generally greater than those found in the settled soil (sludge). (Knapp-USGS)
W69-08028

WASTES IN RELATION TO AGRICULTURE AND FORESTRY,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 05C.
W69-08029

5C. Effects of Pollution

OCCURRENCE AND SIGNIFICANCE OF PESTICIDE RESIDUES IN WATER,
Federal Water Pollution Control Administration, Athens, Ga. Southeast Water Lab.
For primary bibliographic entry see Field 05G.
W69-07704

THE EFFECT OF PUMPED-STORAGE RESERVOIR OPERATION ON BIOLOGICAL PRODUCTIVITY AND WATER QUALITY,
Virginia Commonwealth Univ., Richmond; and Virginia Polytechnic Inst., Blacksburg.
G. M. Simmons, Jr., and S. E. Neff.
Virginia Polytech Inst Water Resources Res Center Bull No 21, Mar 1969. 47 p, 7 fig, 22 tab, 18 ref. OWRR Project No A-012-VA.

Descriptors: *Eutrophication, *Reservoirs, *Pumped storage, Water quality, Nutrients, Sewage, Water pollution, Reaeration, Aeration, Mixing, Stratification, Thermal stratification, Pumping.
Identifiers: Pumped-storage reservoirs.

Smith Mountain Reservoir, Virginia, a pumped-storage hydrogeneration system, which reached its operating capacity in February 1965, has developed some of the limnological attributes of a mesotrophic lake. The impoundment is rapidly developing the characteristics of older, eutrophic, main-stream reservoirs, despite the recycling of large quantities of water during pump-storage operation. The body of water behaves as a warm monomictic lake. A relatively shallow (5-8m) epilimnion forms during stratification. The metalimnion is nearer the surface in the proximity of the dam during pump-back. The anticipated beneficial effects of the recycling process appear to be limited. Seiche action begun by recycling seems to increase carbon assimilation rates in the vicinity of the dam by eddy diffusion of nutrients across the metalimnion. Seiche activity is restricted by basin morphometry, but its influence can be detected 6.5 mi above the dam. In the lower parts of the impoundment, anaerobic conditions in the hypolimnion were not reached although dissolved oxygen concentrations were severely reduced. In the shallower upper reaches of the impoundment, anaerobic conditions developed by late spring. The highest concentrations of dissolved oxygen were encountered in spring and early summer in the epilimnion. Total coliform counts made at various times in the reservoir also emphasize the quantities of effluents that enrich the upper portions of the impoundment. These counts also point out the self-evident fact that water quality improvement in pump-storage reservoirs depends upon the quality of the water which is recycled. (Knapp-USGS)
W69-07711

A TEST SIMULATION OF POTENTIAL EFFECTS OF THERMAL POWER PLANTS ON STREAMS IN THE UPPER MISSISSIPPI RIVER BASIN,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
For primary bibliographic entry see Field 05B.
W69-07738

A RECONNAISSANCE STUDY OF THE CHESAPEAKE BAY,
Regional Planning Council, Baltimore, Md.
For primary bibliographic entry see Field 05G.
W69-07742

PROMISING ANTI-POLLUTANT: CHELATING AGENT NTA PROTECTS FISH FROM COPPER AND ZINC,
Fisheries Research Board of Canada, St Andrews (New Brunswick), Biological Station.
John B. Sprague.
Nature, Vol 220, No 5174, pp 1345-1346, Dec 1968. 1 tab, 10 ref.

Descriptors: *Chelation, *Copper, *Pollution abatement, *Zinc, Bioassay, Brook trout, Lethal limit, Metals, Toxicity.
Identifiers: *Anti-pollution agent, Nitrilotriacetic acid, NTA, Pimephales, Salvelinus.

Copper and zinc are widespread pollutants both in industrial areas (waste spillage) and wilderness areas (mining operations). A chelating agent, nitrilotriacetic acid (NTA) appears to be a promising short-term anti-pollutant. Bioassays involving copper and zinc, alone, in mixtures, and in combination with NTA were carried out on brook trout over periods of ten days. Ten fish were used in each 34-liter bioassay tank (no statement of replications is given), the fish being maintained under conditions otherwise considered optimum for the species. Individual times of death were recorded and lethal thresholds (in milligrams/liter) were obtained for copper (0.05) and zinc (0.75). Thresholds were given a 'toxic unit value' of 1.0. Addition of NTA caused a decrease in toxicity (longer survival of fish) at most concentrations of metals (up to 330 toxic units). NTA chelates at ratios of 1 molecule NTA:1 ion metal and selectively chelates copper before acting upon zinc. NTA is apparently as effective as EDTA and costs less. Tabular material gives selected results of mixed copper-zinc toxicity trials, with and without NTA. (Voightlander-Wisc)
W69-07817

THE GALLOPING GHOST OF EUTROPHY,
New Hampshire Water Supply and Pollution Control Commission.
Terrence P. Frost.
Appalachia, Vol XXXVII, No 1, pp 25-36, June 1968. 1 fig, 4 plates.

Descriptors: *Eutrophication, *Lakes, Glaciation, Urbanization, Domestic wastes, Nutrients, Phosphorus, Algae, Algicides, Harvesting of algae, Environment, Cyanophyta.
Identifiers: *Aesthetic deterioration, *Advanced waste treatment, *Nutrient removal, Agricultural drainage, Appalachian Mountain Club huts, Tegernsee, Germany, Expanding technology, Overpopulation.

The increased influence of man on the environment has caused a change in the definition of eutrophication from a natural aging process of lakes due to topography, degree of fertility, sediment loads from mineral and organic solids, subsurface geology, and weathering, to an accelerated aging due to man's influence. Increasing urbanization along with our changing life style, is suggested as the cause for 'galloping eutrophy.' The effect is the proliferation of algal species, harmless and diversified in small numbers; noxious and confined to profusion of a few hardy blue-green species in overpopulation. The result is aesthetic deterioration, fish kills, septic odors, discoloration of objects

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in water, organic debris buildups on bottoms, scums and mats. Suggested methods of control include chemical treatment with algicides or harvesting organisms, but these eliminate symptoms without reaching the causes. Real need is nutrient removal from sewage effluent by a variety of techniques, coagulation (lime or alum), reverse osmosis, ion exchange, electrodialysis, distillation, hydrophonics, and irrigation. Mention is also made of methods and improvements in waste disposal at Appalachian Mountain Club huts and the Tegernsee Recreation area in Germany. Author's conclusion: The heart of the problem lies in unharnessed technology and people pollution. (Ketelle-Wisc)
W69-07818

DIGITAL COMPUTER SIMULATION OF AN ECOLOGICAL SYSTEM, BASED ON A MODIFIED MASS ACTION LAW,
Pennsylvania Univ., Philadelphia. Johnson Research Foundation.
David Garfinkel, and Richard Sack.
Ecology, Vol 45, No 3, pp 502-507, Summer 1964. 4 fig, 2 tab, 26 ref.

Descriptors: *Digital computers, *Ecosystems, *Simulation analysis, Computer models, Computer programs, Ecology, Systems analysis, Trophic level.
Identifiers: *Mass action law, Ecosystem computer simulation, Plant-herbivore-carnivore system, Ecosystem stability analysis, Theoretical ecology, Lotka-Volterra equations, UNIVAC I, UNIVAC II.

Utilizing digital computer, a simulation model was devised for a six-species ecosystem, starting with Lotka-Volterra's mass-action mechanism and introducing modifications as required by ecological reality. Their computer program permits description of the system in terms of species and their interactions, without requiring manipulation of differential equations. Behavior of the simulated ecosystem is in good agreement with reality, and some testable hypotheses emerge. Some properties of the system: Total biomass in the systems determines highest predatory level it will support; two species cannot simultaneously occupy same food-chain position; important stabilizing influences include sufficiently large predator populations, negative feedback controls on reproduction, and presence of immature predators which have food consumption different from adult or which otherwise affect food consumption of adult; and ecosystems may have time cycles of distinct length, resistant to perturbation. While complex mathematical models may not be ecologically valid, and ecologically valid models may not generate ecologically useful results, computer simulation of realistic ecosystems is feasible without requiring undue mathematical effort by user. (Eichhorn-Wisc)
W69-07823

SEAWEED EXTRACTS AS FERTILISERS,
Portsmouth Coll. of Tech. (England). School of Pharmacy.
G. Blunde, S. B. Challen, and D. L. Woods.
J Sci Food Agric, Vol 19, pp 289-293, June 1968, 1 fig. 8 tab, 26 ref.

Descriptors: *Fertilizers, *Cycling nutrients, Eutrophication, Algae, Plant growth substances, Plant growth, Carbohydrates.
Identifiers: *Seaweed extracts, Ascophyllum nodosum, Alginic acid, Fucus vesiculosus, Growth factors, Laminaria saccharina, Mannitol, Mustard growth test, Organic growth factors, Polysaccharides.

In the mustard-growth test, the growth-promoting effects of aqueous extracts of Laminaria saccharina, Fucus vesiculosus and Ascophyllum nodosum were largely due to the metal cations present, but the effects were modified by organic substances in the extracts. Amino acids and mannitol in seaweed extracts had little effect on plant growth, and compounds extracted with organic solvents were only partially responsible for the modification of the growth-promoting effect. The polysaccharide alginic acid and its salts seemed to be the main organic compounds responsible for reducing the effects of metals and may have competed with the plants by ion exchange for the metals in the extract. (Konrad-Wisc)
W69-07826

THE REACTIONS OF FISH TO WATER OF LOW OXYGEN CONCENTRATION,
University Coll. of Wales, Aberystwyth. Dept. of Zoology.
J. R. Erichsen Jones.
J. Exper Biology, Vol 29, pp 403-415, 1952. 8 fig, 22 ref.

Descriptors: *Behavior, *Dissolved oxygen, *Fish, Brown trout, Minnows, Sticklebacks, Oxygen demand.
Identifiers: *Depleted oxygen, *Dyspnoea, *Swimming reactions, Phoxinus, Salmo trutta, Gasterosteus aculeatus.

The behavior of three species of fish was observed in relation to experimentally induced conditions of low oxygen concentration, the majority of the observations being made on the stickleback. At oxygen concentrations of 2.0 to 3.0 milligrams/liter (mg/1), (temperature 13 C), fish moved easily into areas of low oxygen concentrations, but if remaining there, developed dyspnoea (increased amplitude and frequency of opercular movements) and a random pattern of active swimming. At concentrations below 2.0 mg/1, the response was more rapid, and a definite avoidance response was noted. At concentrations above 3.0 mg/1, results were more variable, with dyspnoea requiring a longer time to develop. At high concentrations, some fish apparently were able to adapt to low oxygen concentrations by increasing the amplitude and frequency of opercular movements. Experiments at higher and lower temperatures yielded the same results, with the response rate varying directly with temperature. The same patterns were noted for Phoxinus and brown trout. Author concludes that random, active swimming, induced by dyspnoea and under the influence of temperature, enables fish to escape areas of low oxygen concentration. (Voigtlander-Wisc)
W69-07830

LIMNOLOGICAL CONDITIONS AND GROWTH OF TROUT IN THREE LAKES NEAR ROTORUA,
Marine Dept., Rotorua (New Zealand).
G. R. Fish.
Proc N Z Ecol Sco, No 10, pp 1-7, 1963. 3 fig, 3 tab, 15 ref.

Descriptors: *Eutrophication, *Growth rates, *Primary productivity, *Rainbow trout, Distribution, Dissolved oxygen, Water temperature.
Identifiers: *Limnological conditions, *New Zealand, *Salmo gairdneri, Lake Okataina, Lake Ngapouri, Lake Okaro, von Bertalanffy curves.

Factors affecting water quality were correlated with growth and population density of trout in three New Zealand lakes. All three lakes stratify and are fed by seepage and surface runoff. Lake Okataina receives no nutrient load in terms of fertilizers and domestic animal sewage, while Lakes Ngapouri and Okaro receive runoff from highly developed agricultural (pasture) land. Secchi disk readings in January were 13.0, 4.0 and 3.6 meters for Okataina, Ngapouri and Okaro, respectively. Estimates of asymptotic length (centimeters) and growth rate (K) were 48.9, 0.09; 23.2, 0.09; 31.0, 0.15, for the respective lakes. Estimated population densities in terms of numbers and weight (transformed to killograms/hectare by abstractor) for the three lakes were: Okataina 13,900, 23.7; Ngapouri 1,500, 23.3; Okaro 720, 16.3. Although differences in growth of trout in the latter two lakes may be related to population density, and the absolute size of the three lakes may be important, it appears that eutrophication resulting from agricultural d
ment has produced an inferior environm
trout in Lakes Ngapouri and Okaro. (Voigt
Wisc)
W69-07831

ALGAE AND MAN.
Syracuse Univ., N.Y. Dept. of Civil Enginee

From Symp on Algae and Man, NATO Ad
Study Inst, Louisville, Ky, 1962. Daniel F. J
(ed). Plenum Press, New York, 1964. 90
tab, 1000 ref.

Descriptors: *Eutrophication, *Algae, Bi
Biological communities, Cultures, Diatoms,
gy, Nuisance algae, Phaeophyta, Photosy
Phytoplankton, Primary productivity, Syste
Water pollution effects, Water pollution
Water supply.
Identifiers: Benthic algae, Blooms, Closed
Cytology, Environmental conditions, Extra
products, Gas exchange, Green plants, M
ture, Medicine, Metabolic patterns, Micr
Micronutrients, Phycology, Space research
algae.

This compendium is based on a series of
presented at the NATO Advanced Study In
the first to be held in the United States, wh
at the University of Louisville, Kentucky,
August 11, 1962. The series bears on the
algae in eutrophication of natural waters
their possible utilization for closed life-
systems in the space age. The scope of the
indicated by names of authors and topics
contributions: G. W. Prescott, systematics;
den Hoek, taxonomy; Tyge Christensen, gro
sification; Margaret Roberts, cytolo
Phaeophyta; G. E. Fogg, environmental co
and algal metabolic patterns; Clyde
micronutrient requirements; A. G.
problems of culture; F. E. Round, ecol
benthic algae; Ruth Patrick, diatom comm
James B. Lackey, ecology of planktonic
Jacob Verduin, principles of primary produ
C. Mervin Palmer, algae in water supplie
Skulberg, eutrophication and bioassay; Ge
Fitzgerald, biotic relations in blooms; Paul
ham, toxic algae; Marcel Lefevre, extra
products; David and Morton Schwimmer
and medicine; Richard J. Benoit, mass cul
gas exchange; and F. Evens, future of phy
WSelected individual contributions to the
will be abstracted individually. (See also Vo
5, Field 5C, W69-01977). (Eichhorn-Wisc)
W69-07832

ALGAL PROBLEMS RELATED TO EUTROPHICATION OF EUROPEAN W SUPPLIES, AND A BIO-ASSAY METH ASSESS FERTILIZING INFLUENCES O LUTION ON INLAND WATERS,
Norsk Institutt for Vannforskning, Blindern.
Olav M. Skulberg.
Algae and Man, Jackson, Daniel F, ed,
Press, N Y, pp 262-299, 1964. 16 fig, 9 tab,

Descriptors: *Algae, *Bioassay, *Eutroph
*Fertilization, *Inland waterways, *Wate
tion effects, *Water supply, Bioindicators
um, Chlorides, Conductivity, Cultures, Hy
ion concentration, Iron, Lakes, Mag
Nutrients, Nuisance algae, Oligotrophy,
Phytoplankton, Sulfates, Sedimentation,
ments, Taste, Water chemistry, Water qualit
Identifiers: *Europe, Algal growth,
trodesmus, Bacillariophyceae, Chloroph
Chrysophyceae, Carteria, Comparative
Crucigenia rectangularis, Diceras C
Dinophyceae, Filter blocking, Heteretroph
Lake Borrevannet Norway, Lake Lugan
Lake Maridalsvannet Norway, Lake Zurich
zerland, Nitelv River Norway, Norway, Osci
rubescens, Oslo Norway, Permanganate
Schizophyceae, Selenastrum capricor
Tabellaria flocculosa.

author lists among the problems caused by ex-
ive algal growth, filter-blocking, impartation of
e and odor to water supplies, discoloration of
er, provision of nutrients for undesirable
rotrophs in pipes, and formation of sediments
kes. To illustrate differences in trophic status
ng lakes, he compares two lakes in Norway:
e Maridalsvannet (3.9 square kilometers; max-
m depth, 45 meters) which provides Oslo with
king water, is oligotrophic, and shows little an-
l variation in its low concentrations of dissolved
ients. Lake Borrevannet (1.8 square km; max
h, 16 meters) is eutrophic and shows important
ual changes with respect to chemistry and water
ity. Author states that Lake Lugano, northern
, has eutrophied due to pollution enrichment,
g classic example of Lake Zurich as evidence
lacustrine trophic changes are best recorded in
sediments. Utilizing Selenastrum (or Ankis-
esmus) capricornutum, an organism requiring
a few days to attain peak growth, author
sed a bioassay to assess effects and concentra-
s of nutrients in natural waters. Such an ap-
ch would appear to have its greatest value in
parative limnological studies. (See also W69-
32). (Eichhorn-Wisc)
9-07833

E BACTERIOLOGY OF INTERFACES,
ns Hopkins Univ., Baltimore, Md. Dept. of
tary Engineering and Water Resources.
rles E. Renn.
c. Rudolfs Res Conf, Rutgers Univ, New Brun-
k, NJ. Principles and Applications in Aquatic
robiology, Heukelekian, H and Dondero, Nor-
C (eds), John Wiley and Sons, Inc, New York,
93-201, 1964. Disc.

criptors: *Bacteria, *Interfaces, Biochemical
gen demand, Boulders, Boundaries (Surfaces),
oms, Emulsions, Films, Foaming, Fouling,
es, Oxygen, Paints, Pipes, Plastics, Rocks,
s, Soil microbiology, Suspensions, Walls,
erproofing, Gages.
tifiers: Rutgers Univ, Woods Hole Oceano-
hic Inst, La Jolla (Calif), Scripps Inst Oceanog-
y, Silicones, Tanks, Zeolites, Atmosphere.

narine studies in the laboratory thin bacterial
s developed on containing walls, and changes in
ratio of surface to volume were related to the
at which oxygen was used. On boats, bacterial
s seemed not to hasten wetting of surfaces, but
r hastening or retarding of attachment of larger
ing organisms was questioned. The interface, a
robiological environment, showed in thin, com-
sed film of rods and cocci gathered on slides
ted on water surface. Fixed surfaces, wetted by
ing water, support films of bacteria and larger
nisms. These mechanisms for purifying waste
er act as stripping systems adsorbing organic
ter and oxidizing it. Heavy sludges appeared in
e-water tanks containing low concentrations of
nic materials. Bacterial slimes, ranging from
ous syrups to rubbery gels, cause clogging in
umidifier sections of air systems. These slimes
mble the dense growth of Sphaerotilus and
lar bacteria in some waste-bearing streams in
ter. The irrigated surfaces of the stream bottom
ave as initial interfaces, but heavy developing
amer growth becomes its own interface. Bub-
in activated sludge treatment serve as inter-
s. Perhaps the affinity of surface-active or-
cs and active bacteria of bubbles aids manipu-
n of activated sludge. (See also Vol. 2, No. 18,
d 5C, W69-07423). (Jones-Wisc)
9-07834

SEARCH IN AQUATIC MICROBIOLOGY: ENDS AND NEEDS,
gers - The State Univ., New Brunswick, N. J.
t. of Environmental Sciences.
Heukelekian, and Norman C. Dondero.
c Rudolfs Res Conf, Rutgers Univ, New Brun-
k, NJ. Principles and Applications in Aquatic
robiology, Heukelekian, H and Dondero Nor-
n, C (eds), John Wiley and Sons, Inc, New
rk, pp 441-452, 1964. 39 ref.

Descriptors: *Aquatic microbiology, *Research and development, *Microorganisms, *Water quality, *Chemical reactions, E coli, Salmonella, Sphaerotilus, Pseudomonas, Azotobacter, Bacteria, Protozoa, Fungi, Actinomycetes, Plankton, Periphyton, Benthos, Biochemistry, Physiological ecology, Nutrients, Tracers, Metabolism, Anaerobic conditions, Ecology, Lakes, Ponds, Cultures, Sampling, Nitrogen fixation, Pollutants, Methane bacteria, Bacteriophage, Soil microbiology.
Identifiers: Aerobacter aerogenes, Vibrio, Bacillus, Bdellovibrio bacteriovorus, Beijerinckia, Media, Special diversity, Industrial raw materials.

In relation to water problems, the potentially fruitful activities toward understanding scientific principles dealing with bacteria, protozoa, fungi, and actinomycetes, are discussed. Composition of bacterial plankton, bacterial periphyton, and benthic bacteria, with their specific biochemical roles, needs study. Adjustment at the species level of microbial populations to chemical or physical changes in environment and their reactions at cellular and molecular levels are significant. Important are: the physiology of the coliform group, apart from the intestinal tract; species composition in different nutrients; greater use of isotope tracer techniques applied to rumen metabolism, benthic decomposition, land anaerobic digestion; certain organic molecules as limiting growth factors; microorganisms surviving and reproducing at low nutrient levels. Long-term programs on ecological significance of bacterial distribution are desirable. An autochthonous flora of lakes and ponds, different in composition from that washed from the soil, may exist. Media and methods of culturing sample collections and preservation of samples require improvement. Studies of particular genera or species are beneficial in that studies of this type lead to more concentrated, intelligible results. Nitrogen-fixing bacteria in association with aquatic plants, the role of Bacillus species in pollution, more work on methane-forming bacteria, a small vibrio behaving like bacteriophage--all are challenging. (See also Vol 2, No 18, Field 05c, W69-07423). (Jones-Wis)
W69-07843

MODELING THE BEHAVIOR OF RADIONUCLIDES IN SOME NATURAL SYSTEMS,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
L. L. Eberhardt, and R. E. Nakatani.
Available from Clearinghouse as CONF 670503 at $3.00 in paper copy and $0.65 in microfiche. Symposium on Radioecology, Proc 2nd Natl Symp, Ann Arbor, Mich, pp 740-750, May 15-17, 1967. 1 tab, 36 ref, disc. CONF-670503.

Descriptors: *Radioecology, *Model studies, Ecology, Food chains, Ecosystems, Systems analysis.
Identifiers: *Radioactivity uptake, Ecosystems modeling, Uptake and retention models.

When the effects of connected compartments and auxiliary influences are ignored, simple uptake and retention models hold promise for use in appraising the substantial variability observed in the radionuclide content of individuals and populations. Although animals tend to function as 'integrators' over their food sources, relative variability in radionuclide content does not increase up the food chain as one might expect. One major cause of observed variances may often be variability in loss and excretion rates. The observed variability in body-burden from individual living in the same general environment may need appraisal in terms of at least three components: (1) that due to fluctuations in intake (stationary and non-stationary), (2) differences in metabolic rates associated with size, and (3) the usual melange of small individual differences which contribute to 'residual error' in a balanced analysis. (See also Vol 2, No 18, Field 05C, W69-07441). (Huff-Wis)
W69-07844

EFFECTS OF TEMPERATURE ON THE SORPTION OF RADIONUCLIDES BY A BLUE-GREEN ALGA,
Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
R. S. Harvey.
Available from Clearinghouse as CONF 670503 at $3.00 in paper copy and $0.65 in microfiche. Symposium on Radioecology, Proc 2nd Natl Symp, Ann Arbor, Mich, pp 266-269, May 15-17, 1967. 7 fig, 2 tab, 5 ref.

Descriptors: *Algae, *Radioisotopes, *Sorption, *Temperature, South Carolina, Cesium, Strontium radioisotopes, Zinc radioisotopes, Iron, Manganese, Benthic flora, Streams, Cultures, Cobalt radioisotopes.
Identifiers: Savannah River Laboratory, Plectonema boryanum, Reactor.

The effects of temperature differential (15 degrees Celsius) on sorption of cesium-137, zinc-65, iron-59, cobalt-57, and manganese-54, by the filamentous cyanophyte, Plectonema boryanum, are reported. The alga was collected from reactor effluent streams. Unialgal cultures were developed. Cultures were grown concurrently at four water temperatures and samples weighed and radio-assayed after exposures of increasing times. This species grew best between 30 C and 40 C. Growth was not affected by low concentrations of radionuclides in the medium. Radionuclide concentrations at the various water temperatures were compared. For a given water temperature, sorption levels differed for the radionuclides studied because of variances in specific activity and biological demand for various elements. The essential elements of manganese-54, xenon-65, cobalt-57, and iron-59, were sorbed to higher levels than were the nonessential elements, strontium-85 and cesium-137, perhaps due in part to their physical state; only cesium-137 and strontium-85 were present, mainly in ionic form. Since sorption levels for the various radionuclides were raised or lowered by factors less than 2.5 by the temperature differential, the conclusion was drawn that nonlethal variations in water temperature have no major influence on the sorption by P boryanum of the radionuclides tested. (See also Vol. 2, No. 18, Field 5C, W69-07441).
W69-07845

ACCUMULATION OF RADIUM-226 IN TWO AQUATIC ECOSYSTEMS,
Utah State Univ., Logan. Dept. of Wildlife Resources.
Susan S. Martin, William T. Helm, and William F. Sigler.
Available from Clearinghouse as CONF 670503 at $3.00 in paper copy and $0.65 in microfiche. Symposium on Radioecology, Proc 2nd Natl Symp, Ann Arbor, Mich, pp 307-318, May 15-17, 1967. 10 fig, 14 ref, disc. CONF-670503.

Descriptors: *Aquatic environments, *Ecosystems, *Radium radioisotopes, *Uranium radioisotopes, Rivers, Mills, Colorado, Wastes, Biological communities, Sediments, Biota, Fish, Utah, Algae, Insects, Invertebrates, Background radiation, Flocculation, Pollutants, Sampling.
Identifiers: Animas River, Durango, San Miguel River, Dolores River, Uravan, Cottus spp, Rhinichthys osculus, Suckers, Ictalurus punctatus, Trichoptera, Odonata, Ephemeroptera, Plecoptera, Diptera, Coleoptera, Hemiptera, Mollusca, Raffinate, Thorium, Tailings.

Radium-226, in uranium processing wastes, seriously affects stream biota. Its accumulation in biotic components was followed for three years. The Animas River, Colorado, after diversion of the most toxic of a mill's effluents, showed excellent recovery biologically. Water, sediment, algae, invertebrates, and fish, were sampled above and below mill sites. Comparison of background levels and radium accumulation showed differences in uptake by various fish species. A concentration factor (the ratio of the concentration of a particular

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radionuclide in the organism to its concentration in the aqueous medium) showed the mean radium-226 content decreasing with downstream distance. During the last two years, radium content of sediments averaged only about three times background levels, earlier samples contained up to twenty times, while still earlier work indicated up to several hundred times the background levels of radium-226. The San Miguel-Dolores River system was in poor biological condition due primarily to chemical pollution from a uranium mill. Biota samples contained increasing amounts of radium-226 as distance below the mill increased, although radium-226 content of the water and sediments decreased with distance. Apparently organisms could not survive long enough in the upper pollution zone to accumulate the amounts of radium-226 which might otherwise be found. (See also Vol. 2, No. 18, Field 5C, W69-07441) (Jones-Wisc)
W69-07846

ECOLOGY OF TWO POPULATIONS OF AN AQUATIC ISOPOD (LIRCEUS FONTINALIS RAF.), WITH EMPHASIS ON IONIZING RADIATION EFFECTS,
Emory Univ., Atlanta, Ga. Dept. of Biology.
C. E. Styron.
Available from Clearinghouse as CONF 670503 at $3.00 in paper copy and $0.65 in microfiche. Symp on Radioecology, Proc 2nd National Symp, May 15-17, 1967, Ann Arbor, Mich, Nelson, Daniel J and Evans, Francis C (eds). US Atomic Energy Comm, Doc CONF 670503, pp 53-60. 2 fig, 2 tab, 32 ref, disc.

Descriptors: *Ecology, *Isopods, *Radiation effects, Environmental effects, River basins, Background radiation, Ecosystems, Granites, Temperature, Droughts, Biological communities, Age, Maple trees, Herbicides, Silts, Dragonflies, Salamanders, Crayfish, Insects, Larvae, Behavior, Life cycles, Georgia.
Identifiers: Lirceus fontinalis, DeKalb County (Ga), Mount Arabia (Ga), Lullwater Creek (Ga), Mutation rate, Beech-maple stands, Physiology, Taxonomy.

Results are reported of comparative study of isopods' biological reactions to various environmental stresses, including ionizing radiation, as well as extending and testing previous biometrical conclusions relative to environmental tolerances. In DeKalb County, Georgia, two populations of Lirceus fontinalis are isolated from each other in separate river drainages and are evolving in response to different environmental stresses. Background radiation counts from naturally occurring radionuclides in granite at Mount Arabia is several times above average for terrestrial ecosystems. Drought and high temperatures apparently are the main ecological factors limiting population on Mount Arabia. These factors are unimportant to the population in Lullwater Creek, where biotic factors have primary ecological significance for Lirceus. On Mount Arabia, tolerances to gamma radiation and drought stress increase significantly with age of Lirceus, which are 7.88 times more tolerant to ionizing radiation stress and 5.36 times more tolerant to drought stress than those of Lullwater Creek. Differences in reactions between Lirceus of Lullwater Creek and Mount Arabia to acute gamma radiation, temperature, and drought stress, may have developed during evolutionary period in response to diverse selection pressures. (See also Vol. 2, No. 18, Field 5C, W69-07441) (Jones-Wisc)
W69-07847

EFFECT OF SUBLETHAL GAMMA IRRADIATION ON THE IRON METABOLISM OF THE PINFISH, LAGODON RHOMBOIDES,
Bureau of Commercial Fisheries, Beaufort, N. C. Radiobiological Lab.
David W. Engel.
Available from Clearinghouse as CONF 670503 at $3.00 in paper copy and $0.65 in microfiche. Symp on Radioecology, Proc 2nd National Symp, May 15-17, 1967, Ann Arbor, Mich, Nelson, Daniel J and Evans, Francis C (eds). US Atomic Energy Comm, Doc CONF 670503, pp 152-156. 3 fig, 1 tab, 13 ref.

Descriptors: *Gamma rays, *Iron, *Metabolism, Blood, Radioactivity, Spectrometers, Size, Sea water, Fresh water, Mammals, Volume, Distribution.
Identifiers: *Pinfish, Kidney, Spleen, Liver, Beaufort Radiobiological Laboratory, Tench, Lagodon rhomboides, Detector.

The hematopoietic system of fish, in contrast to that of mammals, has not been investigated extensively. The effect of acute irradiation of iron metabolism of the pinfish, Lagodon rhomboides, was investigated by measuring specific activities of injected iron-59 (Fe-59) in the blood and tissues of irradiated and unirradiated fish. The radiation dose of 2000 rads markedly disrupted iron metabolism, and affected the distribution of Fe-59 in blood, liver, spleen, and kidney, at different times after irradiation. Decreased specific activity of the blood of irradiated fish for more than 22 days indicated depressed erythrocyte production; increased specific activity above the level of the controls on the 36th day indicated recovery of erythropoiesis. Radiation altered the size distribution of blood cells and the cell volumes, both effects indicating that larger and younger cells were being released into the circulation from 14-28 days after irradiation. Postirradiation changes in specific activities of kidney and spleen suggested that the kidney was the major erythropoietic organ and that the spleen had no more than a minor role in erythrocyte production. Changes in the specific activity of the liver suggested that it functioned only in iron storage and mobilization. (See also Vol. 2, No. 18, Field 5C, W69-07441) (Jones-Wisc)
W69-07848

INTERACTING EFFECTS OF GAMMA RADIATION AND SODIUM HALIDE CONCENTRATIONS ON RAINBOW TROUT,
Utah State Univ., Logan. Ecology Center.
John M. Neuhold, and R. K. Sharma.
Available from Clearinghouse as CONF 670503 at $3.00 in paper copy and $0.65 in microfiche. Symp on Radioecology, Proc 2nd National Symp, May 15-17, 1967, Ann Arbor, Mich, Nelson, Daniel J and Evans, Francis C (eds). US Atomic Energy Comm, Doc CONF 670503, pp 142-151. 9 fig, 3 tab, 15 ref, disc.

Descriptors: *Cesium, *Gamma rays, *Rainbow trout, *Sodium chloride, *Sodium compounds, Time, Oxygen, Habitat, Water, Arid climates, Nuclear explosions, Radioactivity, Temperature, Monitoring, Fluorometry, Chemical properties, Calcium, Magnesium, Mortality.
Identifiers: Excretion, Muscles, Dose levels, Causal interactions, Concentration effects, Osmoregulation, Ion uptake, Ion loss.

Research objective was investigation of effects of gamma ray doses and halide concentrations on rainbow trout survival. Water temperature was maintained at acclimation temperatures and oxygen concentration close to saturation. Fish were irradiated in a cesium-137 (1320 curies) gamma source. After radiation exposure, fish were transferred to experimental units, each with a concentration of sodium halide. Mortality of such irradiated rainbow trout in aquaria, subjected to medium levels of sodium fluoride, sodium chloride, sodium bromide, and sodium iodide, displayed statistically significant responses to following interactions: time by gamma dose, time by sodium halide concentration, or gamma dose by sodium halide concentration. These interactions, apparently caused by radiation, induced changes in oxygen uptake, and in sodium uptake and excretion. Evidence seems to warrant the surmise that mortality early in the experiment resulted from low calcium. The probability that osmoregulatory function is damaged with radiation dose is accepted as an explanation for the pattern of fish mortality in differing salt concentrations. Differential dam
to exchange tissues as well as to gill and renal
sues could cause apparent interactions betw
dose and time or concentration. (See also Vol
No. 18, Field 5C, W69-07441) (Jones-Wisc)
W69-07849

**STRONTIUM-CALCIUM RELATIONSHIPS
AQUATIC FOOD CHAINS,**
Atomic Energy of Canada Ltd., Chalk River (
tario). Environmental Research Branch.
I. L. Ophel, and J. M. Judd.
Available from Clearinghouse as CONF 67050
$3.00 in paper copy and $0.65 in microfiche. Sy
on Radioecology, Proc 2nd National Symp, M
15-17, 1967, Ann Arbor, Mich, Nelson, Dani
and Evans, Francis C (eds). US Atomic Ene
Comm, Doc CONF 670503, pp 221-225. 4 tab,
ref.

Descriptors: *Strontium radioisotopes, *Calci
*Food chains, *Lakes, *Spectrometers, *F
Perches, Bullheads, Lake Huron, Ontario, Can
Carp, Suckers, Ecosystems, Radioactivity, Bi
Streams, Genetics.
Identifiers: *Stable strontium, Bone, Perch L
(Ont), Canada, Dorosoma cepedianum, Kin
dine (Ont), Brasenia schreberi, Ponteceria cord
Typha angustifolia, Nuphar variegatum, Rat
Numphea odorata, Fontinalis, Potamogeton pu
lus, Stomach, Bottom organisms.

This research was undertaken to determine
ferences in strontium content of fish from two la
and to investigate causes for these differences
waters chronically contaminated with strontium
(Sr-90), the amount of the radio-nuclide inc
porated into fish tissues is directly related to
stable strontium content. Human intakes of Sr
will differ in same manner as the stable eleme
Different species of fish from the same lake
identical species in different lakes were found
have marked variations in stable strontium conte
No corresponding variation in calcium conte
was found. Two plant species seem to draw on s
plies of stable strontium which are not in equili
um with the water compartment of the ecosyst
Food organisms in lakes have marked differen
in strontium (Sr) and calcium (Ca) content
Sr/Ca ratios. Stomach contents analyses indicat
correlation between Sr/Ca ratios in food and th
in fish. It appears that differences in stable stro
um (and radiostrontium) content among fish
dependent on feeding habits of the species and n
indicate that individual fish form feeding hal
that persist throughout their life, or that there e
genetic characteristics related to Sr/Ca metaboli
in the fish. (See also Vol. 2, No. 18, Field 5C, W
07441) (Jones-Wisc)
W69-07850

**SEDIMENT RADIOACTIVITY IN THE COLU
BIA RIVER ESTUARY,**
Oregon State Univ., Corvallis. Dept. of Ocean
raphy.
C. David Jennings, and Charles Osterberg.
Available from Clearinghouse as CONF 67050
$3.00 in paper copy and $0.65 in microfiche. Sy
on Radioecology, Proc 2nd National Symp, M
15-17, 1967, Ann Arbor, Mich, Nelson, Danie
and Evans, Francis C (eds). US Atomic Ene
Comm, Doc CONF 670503, pp 300-306. 4 fig
tab, 7 ref, disc.

Descriptors: *Sediments, *Radioactivity, *Colu
bia River, *Estuaries, *Gamma rays, Ecosyste
Biota, Pacific Ocean, Sands, Zinc radioisotop
Chromium, Benthos, Plankton, Nekton, Floccu
tion, Oregon, Washington, Sampling.
Identifiers: Radionuclides, Detector, Analyz
Probe, Hanford (Wash), Half-life.

Because radioactivity concentrates in sediments
study of this phase was made of the Columbia Ri
estuary. Surface layer of sediments, contain
most of the man-made radionuclides, is difficult
remove in its undisturbed state, in quantities su

; for radioanalysis. An in situ probe circum-
s these problems, making possible rapid data
ction allowing quick assessment of radioactivi-
stribution. Radioactivity thus measured closely
esponds with that which benthic organisms ex-
ence. Chromium-51 and zinc-65 had the
est concentrations of the radionuclides
tified, although naturally occurring potassium-
as ubiquitous while cobalt-60 and manganese-
were prevalent. Sediment radioactivity ex-
ed an order of magnitude higher than that of
vater, subjecting benthic organisms in this sedi-
to a considerably higher radiation dose than
lankton or nekton living in the water above.
ibution of sediment radioactivity (fine sedi-
s contain highest concentrations) depends on
ontact with radioactive water, (2) the current
ne set up by river flow, tidal action, and estua-
ape, (3) flocculation of colloidal suspension
contact with ocean water, (4) sediment parti-
ze and composition, and (5) chemical form of
adionuclide as modified by its immediate en-
ment. (See also Vol. 2, No. 18, Field 5C,
-07441) (Jones-Wisc)
-07851

IOSTRONTIUM UPTAKE IN BLOOD AND SH IN BLUEGILLS (LEPOMIS ROCHIRUS),
Ridge National Lab., Tenn. Health Physics

Reed, and D. J. Nelson.
lable from Clearinghouse as CONF 670503 at
) in paper copy and $0.65 in microfiche. Symp
adioecology, Proc 2nd National Symp, May
7, 1967, Ann Arbor, Mich, Nelson, Daniel J
Evans, Francis C (eds). US Atomic Energy
m, Doc CONF 670503, pp 226-233. 3 fig, 2
10 ref, disc.

riptors: *Strontium radioisotopes, Environ-
al effects, Ponds, Springs, Sinks, Autoradio-
hs, Environment, Sunfishes.
ifiers: *Lepomis macrochirus, *Blood, *Flesh,
ake, Half-life, Bones, Scales, Concentrations,
e crappie, Excretion patterns.

ostrontium in fish flesh is important. The rapid
l uptake of radio-strontium by bluegills
omis macrochirus) was attributed to a quickly
anged strontium (Sr) pool in flesh and blood.
r pool in blood consisted of a component hav-
biological half-life of 2 hours. Another 1% of
d Sr exchanged in 35 days and 97% was con-
d in a component with a long, undetermined
gical half-life. Strontium in blood contributed
han 0.09% to Sr in flesh. At least three com-
nents of Sr metabolism were identified in flesh.
Sr in flesh was turned over with a biological
life of about 2 hours, while 9% was turned over
a half-life of 9 days. Remaining 90% of Sr in
had a long but undetermined half-life. Uptake
in the quickly exchanged Sr pool was directly
ortional to Sr concentrations in test solutions
nge 0.3-300 parts per billion (ppb). At 3,000
30,000 ppb Sr, bluegills took up more Sr than
wer concentrations, indicating non-discrimina-
against Sr at abnormally high environmental
entrations. (See also Vol. 2, No. 18, Field 5C,
-07441) (Jones-Wisc)
-07852

ECT OF HANFORD REACTOR SHUT-VN ON COLUMBIA RIVER BIOTA,
elle-Northwest, Richland, Wash. Pacific
hwest Lab.
. Watson, C. E. Cushing, C. C. Coutant, and
. Templeton.
lable from Clearinghouse as CONF 670503 at
0 in paper copy and $0.65 in microfiche. Symp
adioecology, Proc 2nd National Symp, May
7, 1967, Ann Arbor, Mich, Nelson, Daniel J
Evans, Francis C (eds). US Atomic Energy
m, Doc CONF 670503, pp 291-299. 8 fig, 23
disc.

Descriptors: *Biota, *Columbia River, Chromium, Phosphorus radioisotopes, Trophic level, Zinc radioisotopes, Iron, Sediments, Fish, Radioecology, Effluents, Ecosystems, Plankton, Algae, Periphyton, Invertebrates, Adsorption, Phytoplankton, Suckers, Shiners, Caddisflies, Temperature, Flow, Diatoms, Manganese.
Identifiers: *Hanford (Wash), *Reactor, Radionuclides, Assimilation, Ba-La, Half-life, Ptychocheilus oregonensis, Acrocheilus alutaceus, Ulothrix, Cladophora, Prosopium williamsoni.

Closure of the Hanford reactors for an extended period caused rapid and extensive decline in concentration of radionuclides. Chromium-51 (Cr-51) and phosphorus-32 (P-32) decreased two to three orders of magnitude in lower trophic levels. The rapid change of P-32 was probably due to its relative short physical half-life and its rapid turnover in aquatic organisms. This was chiefly a biological process, not merely surface adsorption. Although Cr-51 was abundant, its low concentration in higher levels indicates its minor biological importance. Its relatively high concentrations in plankton, algae, and invertebrates, was probably due to adsorption rather than assimilation. Declines in concentrations of zinc-65 (Zn-65), manganese-54, and iron-59, were much less. Their lesser decline in biota as opposed to river water suggested that these nuclides either are turned over at a very slow rate in the organisms, or that they were available from parts of the ecosystem other than water. In fish P-32 was lost rapidly, Zn-65 slowly. The slower rate of change of radionuclides by fish indicated difference in uptake routes. Near equilibrium concentrations of radionuclides in most river organisms were approached within two or three weeks after resumption of reactor operation. (See also Vol. 2, No. 18, Field 5C, W69-07441) (Jones-Wisc)
W69-07853

CESIUM, CESIUM-137, AND POTASSIUM CONCENTRATIONS IN WHITE CRAPPIE AND OTHER CLINCH RIVER FISH,
Oak Ridge National Lab., Tenn. Health Physics Div.
D. J. Nelson.
Available from Clearinghouse as CONF 670503 at $3.00 in paper copy and $0.65 in microfiche. Symp on Radioecology, Proc 2nd National Symp, May 15-17, 1967, Ann Arbor, Mich, Nelson, Daniel J and Evans, Francis C (eds). US Atomic Energy Comm, Doc CONF 670503, pp 240-248. 5 tab, 23 ref, disc.

Descriptors: *Cesium, *Radioisotopes, *Radioactivity, *Fish, *Potassium, *Tennessee, Drums, White bass, Channel catfish, Seasonal, Strontium radioisotopes, Gamma rays, Spectrometers, Perches, Trophic level, Pikes, Bullheads, Marine fish, Sunfishes.
Identifiers: *Pomoxis annularis, *Clinch River (Tenn), *Concentrations, Biosphere, Environmental pathways, Biogeochemical, Calcium, Half-life, Flounder, Internal organs, Dorosoma cepedianum, Micropterus salmoides, Lepomis macrochirus, Crappies.

Concentration factors are a convenient parameter to compare biogeochemical relationships. Potassium (K) concentrations in white crappie were relatively constant throughout the year and all specimens averaged 3.48 milligrams/gram fresh weight. Other species, including drum, white bass, channel catfish, bluegill, contained similar K concentrations, and the K content was considered a conservative property. Cesium (Cs) concentrations in white crappie flesh were about 0.008 microgram/gram fresh weight from May through July, and during the remainder of the year varied from 0.010 to 0.018 micrograms/gram. In addition to seasonal variations, the Cs content of different species ranged from 0.00344 micrograms/gram in bluegill to 0.0160 in white bass. Concentration factors for K were from 2500 to 2700, while those for Cs were from 140 to 640. The average specific activity of Cs-137 in white crappie flesh was about the same as the average specific activity in Clinch River water. These results showed that specific activities of Cs-137 may be used to predict its concentration in fish for chronic releases of Cs-137 to surface streams. The variable Cs content and the constant K content of fish vitiates application of Cs-137 to K ratios for predictive purposes. (See also Vol. 2, No. 18, Field 5C, W69-07441) (Jones-Wisc)
W69-07854

ACCUMULATION AND DISTRIBUTION OF Mn-54 AND Zn-65 IN FRESHWATER CLAMS,
California Univ., Livermore. Lawrence Radiation Lab.
Florence L. Harrison.
Available from Clearinghouse as CONF 670503 at $3.00 in paper copy and $0.65 in microfiche. Symp on Radioecology, Proc 2nd National Symp, May 15-17, 1967, Ann Arbor, Mich, Nelson, Daniel J and Evans, Francis C (eds). US Atomic Energy Comm, Doc CONF 670503, pp 198-220. 18 fig, 7 tab, 17 ref, disc.

Descriptors: *Clams, *Fresh water, *Manganese, *Radioisotopes, *Zinc radioisotopes, *Distribution, Water, Temperature, Size, Radioactivity, Gonads, Nuclear explosion, Retention, Spectrometers, California.
Identifiers: *Accumulation, Half-life, Calcareous tissue, Digestive tract, Muscles, Excretory organs, Mantle, Gills, Removal, Concentration, San Joaquin River (Calif), Sacramento (Calif), Detector, Labial palps, Foot, Body wall, Body fluid, Lawrence Radiation Laboratory, Heart, Kidney, Uptake, Loss.

Accumulation and distribution of manganese-54 and zinc-65 in freshwater clams was followed for 147 days in an aquarium system designed to maintain constant concentrations of manganese and zinc. Amounts of the radionuclides increased linearly during the uptake period. Concentrations of manganese-54 and zinc-65 showed variation from tissue to tissue, but concentrations within a given tissue were equivalent. After about 100 days, steady-state accumulation and loss were reached in digestive tract, gonad, muscles, and excretory organs. However, in calcareous tissue, mantle and gills, steady-state conditions were not reached in 147 days. Rates of accumulation were found to depend on concentrations of stable element in water, temperature, and sizes of animals. Loss rate of stable element from the clam body was slow: the large long-lived pool of manganese having a half-life of about 1300 days; that of zinc, 650 days. Measurements of specific activities indicated that in all parts of the body, a large fraction of manganese and zinc was in pools with which the radionuclides did not exchange. The main storage site in the body for manganese and zinc (as well as calcium) was in granules in the calcareous tissue. (See also Vol. 2, No. 18, Field 5C, W69-07441) (Jones-Wisc)
W69-07855

CONCENTRATION OF SODIUM BY FRESH WATER TURTLES,
Pennsylvania State Univ., University Park. Dept. of Biology.
William A. Dunson.
Available from Clearinghouse as CONF 670503 at $3.00 in paper copy and $0.65 in microfiche. Symp on Radioecology, Proc 2nd National Symp, May 15-17, 1967, Ann Arbor, Mich, Nelson, Daniel J and Evans, Francis C (eds). US Atomic Energy Comm, Doc CONF 670503, pp 191-197. 3 fig, 2 tab, 14 ref, disc.

Descriptors: *Radioisotopes, *Cycling nutrients, *Fresh water, *Environment, *Sodium, *Turtles, Electrolytes, Cloaca (Zoological), Fish, Ecosystem, Ion exchange, Chlorides, Potassium, Electrochemistry, Habitats, Frogs, Enzymes, Proteins, Calcium.
Identifiers: *Organisms, *Concentration, Pharynx, Zinc, Pseudemys scripta, Terrapene carolina, Influx, Uptake, Trionyx spinifer, Mucosa, Serosa, Plasma.

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Food has been considered to be the primary route of electrolyte uptake in aquatic turtles. Recent investigations of ion fluxes in freshwater turtles (Trionyx and Pseudemys) indicate there can be a significant uptake of sodium (Na) from the environment by means of active transport. Influx measurements in the intact animal and studies of membranes in vitro in an Ussing cell indicated that transport was localized in membranes of the oral and cloacal regions. Na uptake is an important feature of the adaptation of these animals to fresh water, particularly in areas with cold winters. Hibernating turtles in the laboratory or in nature lose large amounts of Na which must be replaced upon emergence by feeding and by active uptake of ions. The mechanism of uptake also appears to be of general use at other times of the year, especially when food intake is reduced. Toxic effects of zinc seemed evident. Freshwater turtles have developed mechanism for Na uptake very similar to ion transport systems found in fish and amphibians. In light of this and their long evolutionary history in aquatic habitats, turtles should be studied further to determine their importance in concentration of dissolved radioisotopes. (See also Vol. 2, No. 18, Field 5C, W69-07441) (Jones-Wisc)
W69-07856

CESIUM-137 IN SOME COLORADO GAME FISH, 1965-66,
Colorado Dept. of Game, Fish and Parks; and Colorado State Univ., Fort Collins. Dept. of Radiology and Radiation Biology.
Wesley C. Nelson, and F. Ward Whicker.
Available from Clearinghouse as CONF 670503 at $3.00 in paper copy and $0.65 in microfiche. Symp on Radioecology, Proc 2nd National Symp, May 15-17, 1967, Ann Arbor, Mich, Nelson, Daniel J and Evans, Francis C (eds). US Atomic Energy Comm, Doc CONF 670503, pp 258-265. 2 tab, 23 ref, disc.

Descriptors: *Cesium, *Radioisotopes, *Fish, *Colorado, Reservoirs, Lakes, Streams, Elevation, Depth, Conductivity, Potassium, Sunfishes, Trout, Salmon, Climates, Soils, Limnology, Physiological ecology, Biological properties, Ecosystems, Latitudinal studies, Precipitation (Atmospheric), Alpine, Rainbow trout, Brown trout, Cutthroat trout, Brook trout, Lake trout, Fallout, Nuclear explosions, Deer, Temperature, Plankton.
Identifiers: Muscle, Area, Pomoxis nigromaculatus, Plains, Foothills, Physiography, Half-life, Lepomis.

During 1965-1966, cesium-137 (Cs-137) concentration in eight game fish species from Colorado waters varied from non-detectable (less than 50) to 5800 picocuries/kilogram. Waters sampled included 3 plains, 2 foothills, 5 montane and 12 alpine reservoirs, lakes, and one plains stream. Elevation of these waters varied from 1538-3498 meters; lake depths, from 1-45 meters; lake areas, from 1.4-230 hectares; lake watershed areas, where measured, from 53-2480 hectares. Conductivity of waters varied from 8-1700 micromhos; potassium concentration, from 0.1-10.3 parts per million. Based on six samples, Cs-137 concentrations were from 2-7 times greater in 1965 than 1966. In general, sunfish, crappies and trout sampled from plains and foothills reservoirs, lakes, and the river contained little or no Cs-137. Trout and salmon from a montane reservoir and one lake contained low or moderate concentrations of Cs-137, whereas those from another montane lake had high concentrations. Trout from alpine lakes and reservoirs contained moderate to high concentrations of Cs-137. Cs-137 concentrations in fish from different waters varied chiefly according to climatic, edaphic and limnological conditions; between species, such concentrations varied with differences in biology and physiology of the species. (See also Vol. 2, No. 18, Field 5C, W69-07441) (Jones-Wisc)
W69-07857

RADIOACTIVE AND STABLE STRONTIUM ANALYSIS OF UPPER MISSISSIPPI RIVER CLAMSHELLS,
Saint Mary's Coll., Winona, Minn. Dept. of Biology.
George Pahl.
Available from Clearinghouse as CONF 670503 at $3.00 in paper copy and $0.65 in microfiche. Symp on Radioecology, Proc 2nd National Symp, May 15-17, 1967, Ann Arbor, Mich, Nelson, Daniel J and Evans, Francis C (eds). US Atomic Energy Comm, Doc CONF 670503, pp 234-239. 2 fig, 3 tab, 13 ref, disc.

Descriptors: *Strontium radioisotopes, *Mississippi River, *Clams, *Fresh water, Benthic fauna, Fallout, Monitoring, Calcium carbonate, Nuclear explosions, Rain, Spectrophotometers, Indicators, Nutrients, Environment, Milk, Wheat, Soils, Minnesota.
Identifiers: Strontium carbonate, Shells, Half-life, Biosphere, Bones, Teeth, Lake Pepin (Minn), Stratosphere, Tap water.

Freshwater clams form a significant portion of the benthic fauna of the Upper Mississippi River biological community. Evidence indicates that they may serve as ideal biological monitors of strontium-90 (Sr-90) concentration not only in the Upper Mississippi River but also of worldwide fallout of this radionuclide. Advantage was taken of the fact that shells of the long-lived clams of this area are composed of distinct annual layers and are chemically composed of calcium and/or strontium carbonate almost exclusively. Shells of live clams of genus Lampsilis collected at end of the 1962-4 growing season were analyzed for both stable and radioactive strontium. Shell layers formed over the ten-year period, 1955-64, showed stable strontium to be consistently 10 orders of magnitude greater than that of radioactive strontium. During this time, stable strontium increased by a factor of only 2, while the Sr-90 increased by a factor of 7. This rise of radiostrontium, while not corresponding with overall strontium increase, did correlate closely with the fallout pattern associated with nuclear weapon testing carried out during this period. Results compare favorably to similar analyses of fallout. (See also Vol. 2, No. 18, Field 5C, W69-07441) (Jones-Wisc)
W69-07858

A TRACER EXPERIMENT WITH I-131 IN AN OLIGOTROPHIC LAKE,
Helsinki Univ. (Finland). Dept. of Radiochemistry.
S. Kolohmainen, S. Takatalo, and J. K. Miettinen.
Available from Clearinghouse as CONF 670503 at $3.00 in paper copy and $0.65 in microfiche. Symp on Radioecology, Proc 2nd National Symp, May 15-17, 1967, Ann Arbor, Mich, Nelson, Daniel J and Evans, Francis C (eds). US Atomic Energy Comm, Doc CONF 670503, pp 278-284. 6 fig, 2 tab, 11 ref, disc.

Descriptors: *Oligotrophy, *Lakes, *Iodine radioisotopes, *Tracers, Ecosystems, Algae, Water analysis, Temperature, Depth, Humic acids, Zooplankton, Perches, Bogs, Pine trees, Fir trees, Cesium, Oxygen, Mud, Rainbow trout, Fallout, Nuclear explosions.
Identifiers: *Finland, Spongilla lacustris, Sphagnum recurvum, Nephar lutea, Cyprinus carassius, Oedogonium, Dysoligotrophy, Bottom animals, Heath, Analyzer, Half-life, Concentration factor.

A tracer experiment with iodine-131 in a natural oligotrophic lake was carried out to provide quantitative information on distribution of this fallout nuclide in all components of a natural ecosystem. Iodine-131 (17 millicuries) was pumped from a moving boat and efficiently mixed within 100 minutes into the lake of 23,000 cubic meters. Samples of water, plants, a sponge, and three species of fish, were collected during 41 days. Results showed that peak radioactivity was reached in all organisms: algae, water plants, a sponge (Spongilla lacustris), and fish (crucian carp (Cyprinus carassius), perch (Perca fluviatilis), rainbow trout (Salmo gairdneri)), within 5 to 7 days. The effective time of radioactivity in the lake water was 6.5 that of the added element, iodine, 36 days. factor in removing iodine from the water wa moss (Sphagnum). Concentration factors c lated by comparing the peak radioactivity of th ganism to the initial radioactivity in the water (nocuries/killogram fresh weight per nann ries/liter water) were: sponge 200, green algae moss 90, water lily (Nuphar luteum) 60, cr carp 25. The animal species showed the lo biological half-lives for iodine. (See also Vo No. 18, Field 5C, W69-07441). (Jones-Wisc)
W69-07859

CESIUM-137 IN FRESHWATER FISH DUR 1954-1965,
Division of Biology and Medicine (A Washington, D. C.
Philip F. Gustafson.
Available from Clearinghouse as CONF 67 at,3.00 in paper copy and $0.65 in microf Symp on Radioecology, Proc 2nd National S May 15-17, 1967, Ann Arbor, Mich, Ne Daniel J and Evans, Francis C (eds). US At Energy Comm, Doc CONF 670503, pp 249-2 fig, 2 tab, 6 ref, disc.

Descriptors: *Cesium, *Freshwater fish, *Fal Perches, Walleye, Spectrometers, Minne Gamma rays, Ecosystems, Bottom sedim Trophic level, Sinks, Sampling, Birds, Plan Scaling, North Dakota, Wisconsin, Nuclear e sions, Precipitation (Atmospheric), Radioactiv Identifiers: Half-life, Body burden, Deposition gonne National Laboratory, Contamination, Lakes (Minn.

Concentrations of cesium-137 (Cs-137) world-wide fallout have been measured in perch and walleyes by gamma ray spectrom Annual collections were made during each (1954-1965) from the same approximate loca Deposition rate and total accumulation of Cs in the area were derived from regional dat making corrections for differences in precipitation. Cs-137 levels changed fairly ra in response to changes in fallout rate; how there was a substantial contribution from acc lated deposition in the aquatic ecosystem w acts as a sink. Solution of a mathematical ex sion relating the concentration of Cs-137 in fi the total amount of Cs-137 present in the lake its rate of deposition, indicated that 25-80% o found in fish came from the long-term accu tion. This accumulation was the more impo source for Cs-137 fish uptake during periods o fallout rate. Effective half-time for Cs-137 i lake system, as inferred from small fish, was a two-and-a-half years. Persistence of Cs-137 freshwater system differs sharply from the beh of terrestrial levels. The continuing availabili Cs-137 to freshwater fish suggests its access to human diet for some time. (See also Vol. 2 18, Field 5C, W69-07441). (Jones-Wisc)
W69-07860

THE ROLE OF TUBIFICID WORMS IN TRANSFER OF RADIOACT PHOSPHOROUS IN AN AQUA ECOSYSTEM,
Western Michigan Univ., Kalamazoo.
Bert K. Whitten, and Clarence J. Goodnight.
Available from Clearinghouse as CONF 6705 $3.00 in paper copy and $0.65 in microfiche. S on Radioecology, Proc 2nd National Symp, 15-17, 1967, Ann Arbor, Mich, Nelson, Dan and Evans, Francis C (eds). US Atomic En Comm, Doc CONF 670503, pp 270-277. 2 f tab, 20 ref.

Descriptors: *Tubificids, *Ecosyst *Phosphorus radioisotopes, *Transfer, Water, teria, Sediments, Minnows, Detritus, Cy nutrients, Plankton, Algae, Invertebrates, Tu ty, Worms, Sunfishes.

tifiers: Radioautographs, Half-life, Concentra- factor, Limnodrilus spp, Aeolosoma hem- ni, Escherichia coli, Myriophyllum, Lepomis rochirus, Pimephales notatus.

umulation of radiophosphorus by tubificid ns (common habitat bottom sediments of ms and lakes) from water, bacteria, and sedi- t, was studied. Tubificid worms took up more phorus from water and bacteria than from nent. These worms were able to accumulate phorus from both soluble and organic particu- sources. Radioautographs demonstrated that h of the activity was in the tissues of these ns and not simply adsorbed. No significant ac- ulation from radioactive orthophosphate, h was adsorbed onto sterile sediments, was ob- ed. Bluegills and bluntnose minnows fed tu- id worms labelled with radiophosphorus accu- ted radiophosphorus in their tissues. Theoreti- calculations based on these feeding studies onstrated that an equilibrium was approached two weeks in the tissues of these fish and was ntained through the duration of the experiment. ficid worms, because of their abundance in e aquatic ecosystems, may have an important in transfer of radioactive phosphorus from r and detritus to other components of the tic ecosystem, such as fish. These worms ap- to function in conjunction with bacteria in the cling of radiophosphorus from detritus and ments. This experimentation is intended to sug- possible relationships which may occur in the ronment. (See also Vol. 2, No. 18, Field 5C, -07441). (Jones-Wisc)
-07861

DIONUCLIDE CYCLING BY PERIPHYTON: APPARATUS FOR CONTINUOUS IN SITU ASUREMENTS AND INITIAL DATA ON C-65 CYCLING,

elle-Northwest, Richland, Wash. Pacific thwest Lab.
. Cushing, and N. S. Porter.
ilable from Clearinghouse as CONF 670503 at 00 in paper copy and $0.65 in microfiche. Symp Radioecology, Proc 2nd National Symp, May 7, 1967, Ann Arbor, Mich, Nelson, Daniel J Evans, Francis C (eds). US Atomic Energy m, Doc CONF-670503, pp 285-290. 3 fig, 1 12 ref.

criptors: *Periphyton, *Cycling nutrients, ic radioisotopes, Streamflow, Sampling, Algae, systems, Environment, Retention, toperiodism, Light intensity, Velocity, Tem- ture, Chemical analysis, Physiological ecology, gen, Carbon dioxide, Carbon radioisotopes, ritus, Columbia River, Electronics, Scaling.
tifiers: *Radionuclide, Ulothrix, Uptake, Half- Detector.

part of the Columbia River program concerns role of the periphyton community in cycling onuclides. Difficulties in studying a large river extremely unstable hydrography have led to elopment of a system having advantages of ratory controlled experiments while maintain- some semblance of natural conditions. It per- the continuous measurement of uptake and ing of radionuclides between stream phyton and a controlled aqueous environment. system was designed to avoid inherent difficul- in aquaria studies, that is, the necessity of roying or sub-sampling the community for ential analyses, the lack of a continuous flow ater over algae to simulate stream conditions, inability to maintain a fixed ambient onuclide concentration because of immediate ake and recycling by the organisms. Apparatus mits evaluation of the effect of individual physi- and chemical environmental factors in either an n one-pass system or in a closed recirculating em. Preliminary results of six uptake and two ntion experiments using zinc-65 in the closed em are presented. Despite community type, is mature or 'young', the time of approximate ilibrium is around 20 hours and the activity ac- cumulated on a weight basis is about 0.021 nanocuries/milligram dry weight. (See also Vol. 2, No. 18, Field 5C, W69-07441). (Jones-Wisc)
W69-07862

RADIOECOLOGY.

Division of Biology and Medicine (AEC), Washington, D. C.

Proc 1st Natl Symp Radioecology, Colo State Univ, Fort Collins, Sept 10-15, 1961. Schultz, Vincent and Klement, Jr, Alfred W (eds). Reinhold Publishing Corp, New York, and Amer Inst Biol Sci, Washington, DC, 1963. 746 p, 294 fig, 261 tab, 2,476 ref, 2 bibliog.

Descriptors: *Conferences, *Radioecology, Fallout, Biological communities, Environmental effects, Ecosystems, Environment, Population, Radioactive waste disposal, Radioactivity, Radioactivity effects, Radioisotopes, Vegetation, Water pollution sources, Water pollution effects, Computer models, Colorado, Food chains, Insects, Fish, Mammals, Plankton, Oceanography, Birds, Limnology, Tracers, Bibliographies, Training.
Identifiers: *Proceedings, Animal sciences, Ecological techniques, Freshwater environments, Nevada Test Site, Marine environments, Plants sciences, Radionuclide cycling, Soil sciences, Terrestrial environments, Fort Collins (Colo).

Volume comprises proceedings of symposium organized to integrate current information in radioecology. Compendium includes text of introductory speaker, 'Impact of Atomic Energy on the Environment and Environmental Science,' and general review papers: 'Radiation Effects and Peaceful Uses of Atomic Energy in the Plant and Soil Sciences,' 'Radiation Effects and Peaceful Uses of Atomic Energy in the Animal Sciences,' 'Continental Close-In Fallout: Its History, Measurement and Characteristics,' 'Disposal of Radioactive Wastes: Its History, Status and Possible Impact on the Environment.' Additional sections (number of contributions per section in parentheses) are entitled: Cycling and Levels of Radionuclides in the Terrestrial Environment (13), Cycling and Levels of Radionuclides in the Marine Environment (12), Cycling and Levels of Radionuclides in the Freshwater Environment (5), Effects of Ionizing Radiation on Plants and Animals in Terrestrial Environments (16), Effects of Ionizing Radiation on Plants and Animals in Marine and Freshwater Environments (6), Ecological Techniques Utilizing Radionuclides in Terrestrial Environments (9), Ecological Techniques Utilizing Radionuclides in Marine and Freshwater Environments (5), Occurrence, Effect and Utilization of Nuclides in the Environment (16). Appendices include: panel report on education and research training and two bibliographies (2,452 entries altogether). Those contributions relevant to aquatic ecosystems will be abstracted separately. (Eichhorn-Wisc)
W69-07863

LETHAL OXYGEN CONCENTRATIONS FOR TROUT AND SMALLMOUTH BASS,

New York State Dept. of Conservation.
G. E. Burdick, Morris Lipschuetz, Howard F. Dean, and Earl F. Harris.
N Y Fish and Game J, Vol 1, No 1, pp 84-97, January 1954. 4 fig, 4 tab, 11 ref.

Descriptors: *Bass, *Environmental effects, *Lethal limit, *Oxygen, *Trout, Estimating equations, Eutrophication, Fishkill, New York, Oxygen demand, Organic wastes, Regression analysis, Temperature, Water chemistry, Water pollution effects, Water quality.
Identifiers: Beebe Lake (N Y), Deer River (N Y), Grout Brook (N Y), Hypoxic environments, Micropterus dolomieu, Rochester (N Y), Rome Fish Hatchery (N Y), Salmo gairdnerii, Salmo trutta, Salvelinus fontinalis, Winkler method.

Sensitivity of fishes to environmental hypoxia increases with rising temperature. Authors constructed curves describing this relationship for trout (brook, brown, and rainbow) and smallmouth bass by plotting mean LOC (lethal oxygen concentration) against temperature on semi-logarithmic paper and fitting the best linear regression line to the plot. They determined LOC by a procedure involving gradual respiratory reduction of oxygen in sealed containers, using loss of equilibrium as an end-point. Highest and lowest concentrations producing such effects were recorded. Regressions so obtained (with temperature ranges, in degrees Fahrenheit, indicated in parentheses) are as follows: brook trout (55-70), Log Y= 0.0135X - 0.54326; brown trout (49-69), Log Y= 0.01248X - 0.46056; hatchery rainbow trout (52.0-71.1), Log Y= 0.01145X - 0.55783; wild rainbows (52-68), Log Y= 0.00979X - 0.48858; Deer River smallmouth bass (54-80), Log Y= 0.00723X - 0.51936; Beebe Lake bass (52.5-80.0), Log Y= 0.00842X - 0.64366, where Y is mean LOC in parts/million, and X is temperature in degrees F. Report includes tabular data bearing on maximum, minimum, median, and mean LOC, with standard deviations and standard errors for the latter. Authors present evidence that their procedures approximate rapid decreases of oxygen in streams intermittently receiving organic wastes. (Eichhorn-Wisc)
W69-07864

THE SUBMERGED AQUATICS OF UNIVERSITY BAY: A STUDY IN EUTROPHICATION,

Wisconsin Univ., Madison. Dept. of Botany.
Christopher T. Lind, and Grant Cottam.
Amer Midland Naturalist, Vol 81, No 2, pp 353-369, April 1969. 4 fig, 6 tab, 17 ref.

Descriptors: *Submerged plants, *Eutrophication, Wisconsin, Aquatic plants, Bioindicators, Water pollution effects, Biological communities, Environmental effects, Floating plants, SCUBA diving, Oligotrophy, Plant growth, Biomass, Phenology.
Identifiers: *University Bay (Wisc), *Lake Mendota (Wisc), Dane County (Wisc), Madison (Wisc), Myriophyllum exalbescens, Potamogeton amplifolius, Potamogeton illinoensis, Compositional gradient (Swindale-Curtis), Ceratophyllum demersum, Compositional indices, Sand bar (Scirpus) community, Floating leaved community, Vallisneria community, Shallow submerged community, Myriophyllum-Vallisneria community, Myriophyllum community, Species frequency, Species diversity, Species density, Vallisneria americana.

Authors studied submerged aquatic plants in Lake Mendota, Wisconsin, by sampling 21 transects, extending perpendicularly from the shore to that point in University Bay where their growth ceased. All plants intercepting the line were recorded within consecutive half-meter linear segments. Data were used to construct a contour map of vegetated portions of bay and to delimit six plant communities found there. Samples collected biweekly from four quadrats provided information on plant heights and standing crops. Report includes following tabulated data: variation in depth of plant growth; species list by relative and percentage frequency; species composition and Compositional Indices for six communities; average densities by quadrat; 1922 species list; and quantitative changes (45 years) in species composition. Collected data were compared with studies made in 1922. Marked changes in vegetation have occurred, the principal differences being a great increase in Myriophyllum exalbescens, and disappearance of Potamogeton amplifolius and P illinoensis, former major components of the vegetation. Based upon a quantitative compositional gradient of 400 points, representing lakes from oligotrophic to eutrophic, this bay has reached its ultimate limit of eutrophication, and its future is apparently one of decreasing species complexity and increasing problems to human users. (Eichhorn-Wisc)
W69-07866

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SOME LIME-INDUCED CHANGES IN LAKE METABOLISM,
Wisconsin Univ., Madison. Lab. of Limnology.
Raymond G. Stross, and A. D. Hasler.
Limnology and Oceanography, Vol 5, No 3, pp 265-272, Nov 1964. 5 fig, 2 tab, 18 ref.

Descriptors: *Cycling nutrients, *Lakes, *Lime, Bicarbonates, Calcium, Colloids, Dystrophy, Eutrophication, Iron, Light penetration, Limnology, Magnesium, Organic matter, Oxygen demand, Phosphorus, Water chemistry, Water quality, Wisconsin.
Identifiers: *Experimental limnology, Bog lakes, Iron cycle.

Hydrated lime was applied to lakes George, Corrine, and Peter, in northern Wisconsin, utilizing Paul Lake as an untreated natural reference. These bog-type, dystrophic lakes are all slightly acid and stained with organic colloids. Light penetration increased in all treated lakes; depth of euphotic zone increased by 22% in George, 40% in Corrine, 60% in Peter. After six weeks, pH of George Lake had decreased from 9.4 to 7.2, immediately after treatment. Because lime does not remove all colloids equally well, light penetration alone may not adequately indicate change in degree of dystrophy. Lime may efficiently precipitate only more unstable colloids, whereupon oxygen demand may decrease without measurably influencing water clarity. Data included in report suggest that normal precipitation of phosphorus by iron was unaffected by treatment of Peter Lake. (Eichhorn-Wisc)
W69-07868

LIMITATION OF NUTRIENTS AS A STEP IN ECOLOGICAL CONTROL,
Wisconsin Univ., Madison. Hydraulic Lab.; and Wisconsin Univ., Madison. Sanitary Lab.
Gerald W. Lawton.
Trans of Seminar on Algae and Metropolitan Wastes, Robert A Taft San Eng Center, Cincinnati, Ohio, TR W61-3, pp 108-117, April 27-29, 1960. 12 fig, 3 tab, 15 ref.

Descriptors: *Nutrients, *Eutrophication, *Sewage effluents, Nitrogen, Phosphorus, Wisconsin.
Identifiers: *Ecological control, *Effluent diversion, *Diversion effects, *Madison lakes, Algal nuisance, Odor nuisance, Nutrient sources, Chemical studies, Inorganic nitrogen, Organic nitrogen, Soluble phosphorus, Volatile suspended solids, Algae sample concentration, Algae species diversification, Madison (Wis), Lake Mendota (Wis), Lake Monona (Wis), Lake Wingra (Wis), Lake Kegonsa (Wis), lake Waubesa (Wis), Biological studies.

Algal nuisance and odor problem plagueing Madison lakes for years, was first attributed (1920) to decomposition of abundant algal blooms, promoted by nutrients contained in municipal and industrial wastes. The Governor's Committee (1943), determined that Madison's sewage plant effluent contributed the bulk of nutrients to Lakes Waubesa and Kegonsa. By 1958, a 1943 legislative bill was implemented and effluent diverted via Badfish Creek to a point below the Madison lakes. From average flow of the Yahara River and the calculated volumes for Lakes Waubesa and Kegonsa, it was projected that diversion would eliminate the overenrichment rapidly; however actual reduction of this overenrichment was considerably less due to trapped nutrients in bottom muds and incomplete mixing. To evaluate effects of diversion, chemical and biological studies have been conducted since 1959, utilizing twelve data collection stations from Lake Mendota to lower Badfish Creek. Graphs of inorganic nitrogen, organic nitrogen, soluble phosphorus, and volatile suspended solids, for each lake during 1922-1959, show the effects of diversion on each parameter. Data concerning plankton species diversification during 1955-1959 show Lakes Monona and Kegonsa had no appreciable change while in Lake Waubesa, number of species increased sharply after diversion. (Ketelle-Wis)
W69-07869

LAKE LYNGBY SO: LIMNOLOGICAL STUDIES ON A CULTURALLY INFLUENCED LAKE,
Copenhagen Univ., Hillerod (Denmark). Freshwater-biological Lab.
Sigurd Olsen.
Folia Limnologica Scandinavica, No 7, 157 p, 1955. 63 fig, 13 tab, 310 ref.

Descriptors: *Eutrophication, *Limnology, *Lakes, Sediments, Nutrients, Aquatic productivity, Bottom sediments, Chemical properties, Diurnal distribution, Water analysis, Hydrology, Annual turnover, Vegetation, Stratification, Sewage effluents, Human population, Water pollution sources, Water pollution effects, Water chemistry, Silicon, Chlorides, Nitrogen, Calcium, Phosphorus, Oxygen demand, Oxygen, Hydrogen ion concentration, Temperature, Optical properties.
Identifiers: *Lake Lyngby So, Cultural eutrophication, Fura River, Denmark.

Situation and character of environs of Lake Lyngby So are described from the point of view of physical ancd chemical limnology, cultural history and biology. The increase in population around the lake is taken as an indicator of intensified eutrophication. Hydrology of the lake, influences on conditions of runoff and subsoil water, are mentioned, including clearing of forests and intensification of agriculture. Composition of the water changes upon passage through the lake, and chemical composition of the waters which were not directly connected with the lake differs from that of lake. Annual variation of temperature, transparency, color, dissolved oxygen, pH, alkalinity, calcium, phosphorus, silicon, chloride, nitrogen, and oxygen consumption is demonstrated with diagrams of surface and deep water samples. The occurrence of summer and winter stagnation under special conditions can be accentuated by incomplete mixing of water from River Fura. Diurnal variation, influenced by weather conditions, has been demonstrated for temperature, pH, and oxygen. The physical and chemical variations in bottom muds are illustrated. (Bortleson-Wisc)
W69-07870

CHLORINATED HYDROCARBON PESTICIDES IN CALIFORNIA BAYS AND ESTUARIES,
California State Dept. of Fish and Game, Menlo Park. Marine Resources Operations.
For primary bibliographic entry see Field 05B.
W69-07920

A SYMPOSIUM ON ESTUARINE FISHERIES.
American Fisheries Society, Washington, D. C.
For primary bibliographic entry see Field 02L.
W69-07986

WASTES IN RELATION TO AGRICULTURE AND FORESTRY,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
Cecil H. Wadleigh.
Dep Agr Misc Publication No 1065, Mar 1968. 112 p, 1 fig, 4 tab, 139 ref, 4 append.

Descriptors: *Water pollution sources, *Water pollution effects, *Agriculture, *Forestry, Agricultural chemicals, Fertilizers, Pesticides, Farm wastes, Farm management, Organic wastes, Industrial wastes, Forest management, Sediment load, Microorganisms.
Identifiers: Farm and forestry wastes.

The sources and effects of wastes contributed to air, water, and soil by agricultural and forestry management practices are briefly discussed. The major waste categories considered are radioactivity, chemical air pollutants, airborne dusts, sediments, plant nutrients, inorganic chemicals, organic wastes, infectious agents, allergens, industrial and agricultural chemicals, and heat. A bibliography of 139 entries is included. Appendices discuss wastes adversely affecting agriculture and forestry, research on waste management, and problems in waste management needing mor tention. (Knapp-USGS)
W69-08029

A CONTINUED PRE- AND POSTIMPOU MENT SURVEY OF THE HELMINTH CRUSTACEAN PARASITES OF MICROPTE DOLOMIEUI LACAPEDE, M. PUNCTULA (RAFINESOUE) AND M. SALMOI (LACEPEDE) (PERCIFORMES) OF BEA RESERVOIR IN NORTHWESTERN ARK SAS,
Arkansas Univ., Fayetteville. Dept. of Zoology.
For primary bibliographic entry see Field 02H.
W69-08121

5D. Waste Treatment Processes

COMPUTER AIDED DESIGN OF WA WATER COLLECTION AND TREATM SYSTEMS,
Michigan Univ., Ann Arbor. Dept. of Environ tal Health.
Rolf A. Deininger.
Mich Univ School Public Health Final Re OWRR, Feb 1969. 15 p, 5 fig, 12 ref. OWRR No. A-108-MICH.

Descriptors: *Waste water treatment, *Sys analysis, *Optimization, *Sewers, *Design, work design, Hydraulic design, Mathema models, Digital computers, Design criteria, M studies, Research and development.
Identifiers: Sewage treatment design.

Systems analysis techniques were studied as a in the design of waste water collection and t ment systems. The research was in the opti design of sewer systems, the optimum desig treatment plants, computer-aided conventi plant design, and the feasibility of generating struction plans on automatic plotting equipm (Knapp-USGS)
W69-07714

THE RECLAMATION OF POTABLE WA FROM WASTEWATER,
Council for Scientific and Industrial Research, toria (South Africa).
G. J. Stander, and L. R. J. Van Vuuren.
J Water Pollut Contr Fed, Vol 41, No 3, pp 367, Mar 1969. 13 p, 11 fig, 1 tab, 8 ref.

Descriptors: Sanitary engineering, *Potable w Domestic water, Municipal water, Waste t ment, *Waste water treatment, *Waste w *Water reuse, Water treatment, *Tertiary t ment, Sewage effluents, Sewage treatment, *W purification, Filtration, Foreign research, F tion, Pilot plants.
Identifiers: *Waste water reclamation, Waste w use, South Africa.

Research results on potable water reclama from humus tand effluent and primary clar waste water are reported by the National Inst for Water Research of the Republic of S Africa. A pilot plant is described for advanced tiary treatment of waste water plant effluents. pilot plant has a 1200-gal/hr capacity and con of: (1) flotation unit, (2) ammonia stripper, (3) bilizer, (4) sand filter, (5) foam fractionator, chlorination tank, and (7) activated carbon fi Functions of the units are discussed and test re summarized. Results show that the advanced p cal-chemical treatment process can produce p ble water from humus tank effluent and prim clarified waste water at an overall cost of $0.25 $0.31 per 1000 gal, respectively. (USBR)
W69-07772

SPRAY IRRIGATION FOR THE REMOVAL NUTRIENTS IN SEWAGE TREATMENT PL EFFLUENT AS PRACTICED AT DETR LAKES, MINNESOTA,
Larson (Winston C.), Detroit Lakes, Minn.

nston C. Larson.
B SEC TR W61-3. Robert A. Taft Sanitary Engeering Center, Cincinnati, Ohio, Trans of minar on Algae and Metropolitan Wastes, pp 5-129, April 27-29, 1960.

scriptors: *Sprinkler irrigation, *Sewage treatnt, *Nutrients, Phosphorus, Nitrogen, Rates of plication, Costs, Eutrophication, Minnesota, rdness (Water), Water quality control.
ntifiers: *Nutrient removal, Algal growth, Lake dy, Alum coagulation, Lime coagulation, Ridge furrow method, Effluent ponding, Litigation, ound-water quality, Detroit Lakes, Minnesota.

e history of sewage treatment and disposal, by a ort town in an area of recreational lakes in Minota, is described. Investigation of methods of rient removal resulted from a lawsuit brought inst the city by property owners on a wnstream lake in which increasing algal blooms re becoming a nuisance. Minnesota Department Health made recommendations for a study pro- m of the problem. Consideration was given to experimental alum coagulation method, studied he University of Wisconsin, and lime coagula- n experiments at Detroit Lakes, by the Minota Department of Health. Ponding of effluent s also considered, but irrigation was the method lly selected. Site investigation was carried out determine soil permeability, effects of vegeta-, probability of odors, operating conditions in ter, and effects on ground water. Cost of initial tallation (1955) to handle 600 gpm was $6,500. ect on ground water was determined by before after samples from a test well which showed a " rise in water level in four years; total increases ppm: phosphorus, 0.6 to 2.9; nitrogen, 2.6 to 2; hardness, 300 to 420. Operating costs of the tallation are essentially that of power requirents. (Ketelle-Wisc)
9-07820

E PHYSIOLOGY OF THE COLIFORM OUP,
bert A. Taft Sanitary Engineering Center, Cinnati, Ohio. Div. of Water Supply and Pollution ntrol.
primary bibliographic entry see Field 05A.
9-07835

E METHANE FERMENTATION,
nford Univ., Calif. Dept. of Civil Engineering.
primary bibliographic entry see Field 05A.
9-07837

ANSFORMATIONS IN INFILTRATION NDS AND IN THE SOIL LAYERS IMEDIATELY UNDERNEATH,
search Institute for Public Health Engineering O, The Hague (Netherlands). Water, Soil, and Div.
. Baars.
c Rudolfs Res Conf, Rutgers Univ, New Brunck, NJ. Principles and Applications in Aquatic crobiology, Heukelekian, H and Dondero, Norn C (eds), John Wiley and Sons, Inc, New York, 344-365, 1964. 8 fig, 2 tab, 9 ref, disc.

scriptors: *Infiltration, *Ponds, *Soil, Groundter basins, Water supply, Mud, Benthos, drogen, Bacteria, Aerobic bacteria, Metabolism, nals, Sands, Chlorination, Microorganisms, emical analysis, Temperature, Nitrates, Plants, mmonia, Hardness (Water), Acidity, Oxygen, Al-, Self-purification, Bacteriophage, Reservoirs, ores, Nitrites, Iron, Organic matter, Subsoil, locity, Oxidation, Denitrification, Sulfates, duction (Chemical), Fermentation, Methane, drogenation, Chemical oxygen demand, chemical oxygen demand, Potassium comunds, Carbon dioxide, Protozoa, Sewage, dge, E coli.
ntifiers: *Transformations, Amsterdam, Haarn, Leyden, The Hague, Mineralization, Clay len-, Rhine River, Amsterdam Rhine, Polders, Comition, Pseudomonas, Mycobacterium, Bacillus subtilis, Bacillus mycoides, Bacillus mesentericus, Diatomea, Cladophora, Flagellata, Ciliates, Ranunculus circinatus, Potamogeton pusillus.

Water from storage ponds, filtered through bottom mud and a body of sand, was measured for chloride, forms of nitrogen, oxygen, organic matter, algae, and bacterial content. To study benthos, water was analyzed from wells constructed at distances from a pond in the direction of flow. Not only dissolved organic matter, as determined by the potassium permanganate method, is mineralized, but much more oxidant (free oxygen plus nitrate oxygen) is used, apparently in the benthos. The high oxidant consumption indicates that the reduction of organic matter is intense. Organic substances, detectable by taste, are not completely eliminated. When there is a constant supply of new oxidant, dead biological materials may be mineralized aerobically. If this supply is terminated, anaerobic transformations may dominate. Probably bacteria are strongly adsorbed to the sand grains in concentrations resulting in intense struggle for life and decrease rapidly with increasing distance from the pond. Samples from the bottom of the ponds downward showed pronounced decrease in bacteria at 0.5-meter depth. A small amount of silt in the water may cause clogging of the soil. The intermittent infiltration system affords the same permeability of the sand each year with the consequent use of available purifying actors. (See also Vol. 2, No. 18, Field 5C, W69-07423). (Jones-Wisc)
W69-07838

PROTEOLYSIS AND PROTEOLYTIC ORGANISMS,
Wallerstein Co., Staten Island, N. Y.
Samuel R. Green.
Proc Rudolfs Res Conf, Rutgers Univ, New Brunswick, NJ. Principles and Applications in Aquatic Microbiology, Heukelekian, H and Dondero, Norman C (eds), John Wiley and Sons, Inc, New York, pp 430-440, 1964. 4 tab, 36 ref, disc.

Descriptors: *Microorganisms, *Bacteria, *Hydrolysis, *Proteins, *Synthesis, Fungi, Enzymes, Wastes, Sewage, Nutrient requirements, Amino acids, Sludge, E coli, Metabolism, Effluents, Filters, Biochemical oxygen demand, Milk, Phosphates, Dairy industry, Carbohydrates, Peptides, Streptococcus, Pseudomonas, Aircraft, New Jersey.
Identifiers: *Proteolysis, Streptomyces griseus, Sepedonium, Space, Aerobacter cloacae, Bacillus subtilis, Bacillus mesentericus, Bacillus cereus, Achromobacter delicatulum, Penicillium, Fusarium aquaeductum, Oospora, Phonia, Trichosporon cutaneum, Geotrichum, Nocardia actinomorpha, Paracolobactrum aerogenoides, Escherichia intermedia, Zooglea ramigera, Gelatin, Casein, Glucose, Lactose, Starch, Alcaligenes bookeri, Alcaligenes faecalis, Flavobacterium aquatile, Flavobacterium balustinum, Flavobacterium devorans, Feces, Clarifiers, Bacillus circulans, Bacterium linens, Bacillus endorhythmos, Leuconostoc mesenteroides, Bacillus amyloliquefaciens, Bacillus natto, Clostridium, Aspergillus.

Proteolytic microorganisms and their enzyme systems play important roles in sewage disposal systems and in the closed ecological system which contains a microbial population capable of generating a food supplement from wastes. The cultural characteristics of floc-forming bacteria from activated sludge, intermittent sand filters, and actively assimilating dairy waste sludge, are significant. Certain Bacillus and Bacterium species seem to be responsible for high purification rates and ability of the sludge to remove and store oxygen-demanding substances. No microbial enzymes have been clearly shown to be active only on proteins. All have been found to possess wide ranges of side-chain specificity. Usually, utilizable carbohydrates supply the energy for synthesis of protein and incorporation of amino acids into microbial protein. There is still doubt that microbial ribosomes alone are responsible for peptide bond formation and synthesis of soluble protein. Difficulties remain in relating in vitro incorporation of amino acids into ribosomes to the synthesis of protein in vivo. How deoxyribonucleic acid is involved in synthesis of bacterial enzymes is not yet completely clear. It is difficult to state that there is necessarily one correct series of reactions or one path of protein biosynthesis. (See also Vol. 2, No. 18, Field 5C, W69-07423). (Jones-Wisc)
W69-07842

WASTEWATER RECLAMATION AND EXPORT AT SOUTH TAHOE,
South Tahoe Public Utilities District, South Lake Tahoe, Calif; and Hill (Clair A.), Redding, Calif.
Russell L. Culp, and Harlan E. Moyer.
Civil Eng, Vol 39, No 6, pp 38-42, June 1969. 5 p, 3 photo, 1 tab.

Descriptors: *Water reuse, *Sewage treatment, *Nevada, *California, *Lakes, Waste water disposal, Inter-basin transfers, Water pollution control, Water quality control, Tertiary treatment, Activated carbon, Filtration, Reclaimed water.
Identifiers: *Lake Tahoe.

The 7.5-mgd reclamation plant at the South Tahoe Public Utility District is the most advanced full-scale wastewater treatment plant in the world. Treatment consists of 2 basic parts, liquid processing and solids handling. The first 2 steps of liquid processing are the conventional ones of primary, or solids separation, and secondary, or biological oxidation. In addition, the advanced treatment provides chemical treatment and phosphorus removal, mixed-media filtration, activated carbon adsorption, and disinfection. The solids handling system provides for incineration of biological sludge, regeneration and reuse of granular activated carbon, and recalcining and reuse of lime, all by means of multiple hearth furnaces equipped with scrubbers and afterburners. Results to date indicate that the plant removes all of the suspended solids, color, odor and bacteria; most of the BOD, COD, MBAS, and phosphorus; and 50 to 98% of the nitrogen. Reclaimed water is exported from the Tahoe Basin and used to irrigate croplands. (Knapp-USGS)
W69-07922

ANIMAL WASTES--A NATIONAL PROBLEM,
Cornell Univ., Ithaca, N. Y. Dept. of Agriculture; and Cornell Univ., Ithaca, N. Y. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05B.
W69-08010

NITROGEN LOSSES FROM ALKALINE WATER IMPOUNDMENTS,
San Diego State Coll., Calif. Dept. of Civil Engineering.
Frank E. Stratton.
ASCE Proc, J Sanit Eng Div, Vol 95, No SA2, Pap 6495, pp 223-231, Apr 1969. 9 p, 5 fig, 1 tab, 3 ref. Grant No GK-1623 NSF.

Descriptors: *Denitrification, *Ammonia, *Nitrogen cycle, *Eutrophication, Water treatment, Sewage treatment, Water pollution control, Waste water treatment, Lagoons, Biodegradation.
Identifiers: *Nitrogen removal.

Results of an investigation of gaseous ammonia nitrogen losses from alkaline water impoundments are presented. A method of field measurement of these losses is described and a comparison made between rates of loss predicted from a study of impounded water samples with rates of loss obtained by direct field measurement. Results indicate that warm eutrophic impoundments are potentially able to liberate significant quantities of gaseous ammonia nitrogen to the atmosphere due to natural degasification processes. (Knapp-USGS)
W69-08011

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CONSERVATION OF WATER BY REUSE IN SOUTH AFRICA,
Council for Scientific and Industrial Research, Pretoria (South Africa).
G. J. Stander, and J. W. Funke.
Water Reuse Amer Inst Chem Eng Progr Symp, Ser No 78, Vol 63, pp 1-12, 1967. 12 p, 16 fig, 6 tab, 11 ref.

Descriptors: *Water reuse, *Reclaimed water, *Sewage treatment, Industrial wastes, Municipal wastes, Water utilization, Byproducts, Chemical wastes, Pulp wastes.
Identifiers: *South Africa, Breweries, Vaal River (S. Africa).

The present water potential for urban, industrial, and agricultural development in South Africa is only 900 gal/person/day, as compared with the 3,700 gal/person/day in the USA. The reuse of water in South Africa, especially in highly industrialized areas such as the Vaal Triangle which produces about 50% of the country's manufacturing output, is becoming a major issue. Although reuse of water in South Africa can, and probably will, be vastly increased, significant instances of such practice already exist. The following cases are briefly discussed; reclamation of sewage effluent for domestic recycling at Windhoek, South West Africa, based on successful pilot-scale investigations; use of biologically oxidized sewage effluent as cooling water in power generation; use of purified sewage effluent in pulp and paper manufacture; and the conservation of water by reuse within factories. Examples cited in the latter category include a beer brewery; an organic chemical industry in which the replanning of water management has, apart from a considerable saving in water consumption, resulted in the recovery of salable by-products; and a major iron and steel industry where stringent water economy is practiced. Emphasis is placed on the key role of research in water resources exploitation. (Knapp-USGS)
W69-08031

CONSERVATION OF WATER BY REUSE IN THE UNITED KINGDOM,
Water Research Association, Medmenham (England); and Water Resource Board, Reading (England).
Derek G. Miller, and David H. Newsome.
Water Reuse, Amer Inst Chem Eng Progr Symp, Ser No 78, Vol 63, pp 13-31, 1967. 19 p, 9 fig, 3 tab, 30 ref.

Descriptors: *Water reuse, *Reclaimed water, *Sewage treatment, Industrial wastes, Municipal wastes, Water utilization, Water temperature, Water loss, Water pollution, Costs, Water conservation.
Identifiers: *United Kingdom.

The historical background of water supply in the United Kingdom and the influence of recent legislation on water resources planning and effluent control are outlined. General consideration is given to available resources and the development of the pattern of demand. The principles of recycling are considered in relation to the overall effects and the impact on individual users. In particular the questions of effluent quality and disposal are discussed in the light of past practices. Some of the commonly used treatment methods are described and are shown to consist mainly of techniques to remove suspended solids and certain organic materials. Examples are given of recycling applications in the United Kingdom which have mainly arisen due to the shortage of water in certain areas. Finally, the paper attempts to assess the likely trends and possible limitations in the future use of recycling techniques. (Knapp-USGS)
W69-08032

CONSERVATION OF WATER BY REUSE IN ITALY,
Azienda Acquedotto Municipale di Torina (Italy).
Fulvio Meucci.
Water Reuse, Amer Inst Chem Eng Progr Symp, Ser No 78, Vol 63, pp 32-36, 1967. 5 p, 5 fig, 1 tab, 11 ref.

Descriptors: *Water reuse, *Reclaimed water, Sewage treatment, Industrial wastes, Municipal wastes, Water utilization, Water temperature, Water pollution, Water conservation, Groundwater, Aquifers, Irrigation water, Water supply, Water resources development, Costs.
Identifiers: *Italy.

Water reuse in Italy is affected by underground availability and water rates. Three Italian reuse plants are described: In a sugar factory after simple sedimentation and sterilization, washing and conveying waters are recirculated; in a metal-working factory, acidic and alkaline waters are singly treated for removing cyanide and chromium and then mixed, neutralized, and clarified to be reused in a rain irrigation system and in fire protection; in a steel pipe mill, acid-washing waters and cooling waters, containing iron slags, are recirculated after oil removal, addition of hydrated lime, and clarification by ferrous sulfate, and cooling. (Knapp-USGS)
W69-08033

CONSERVATION OF WATER BY REUSE IN MEXICO,
Celulosa y Derivados, S.A., Monterrey (Mexico).
Carlos Griffith.
Water Reuse, Amer Inst Chem Eng Progr Symp, Ser 78, Vol 63, pp 37-40, 1967. 4 p, 8 tab.

Descriptors: *Water reuse, *Reclaimed water, *Sewage treatment, Water quality, Industrial wastes, Municipal wastes, Water utilization, Water conservation, Irrigation water, Water supply.
Identifiers: *Mexico.

Water is reclaimed for reuse in Mexico in 16 plants by the activated sludge process. Total capacity is 85.5 mgd. Most of the water is used for cooling, fire protection, and irrigation. Chemical analyses of water from each stage of treatment are tabulated. (Knapp-USGS)
W69-08034

WATER REUSE IN WEST GERMAN INDUSTRY,
Ruhrverband, Essen (West Germany).
Norbert Wolters.
Water Reuse, Amer Inst Chem Eng Progr Symp, Ser No 78, Vol 63, pp 41-45, 1967. 5 p, 5 fig, 8 ref.

Descriptors: *Water reuse, *Reclaimed water, Industrial wastes, Municipal wastes, Water utilization, Costs, Taxes, Sewage treatment, Water resources development, Water pollution treatment.
Identifiers: *Germany, Ruhr Valley, Rhine Valley, Sewage taxes, Pollution taxes.

The great concentration of water-using industries in the Ruhr Valley, and the need to minimize pollution of the River Rhine, have forced maximum intraplant reuse of water. Special efforts are made in new plant design to make more effective reuse possible, resulting in the case of one steel mill completely reusing all incoming water. The creation of area water management associations that charge individual plants on the basis of pollution load of their effluents makes it worthwhile to continue studies for more efficient reuse. Special problems associated with beet sugar, coal mining, electroplating, and heavy chemicals industries are discussed.
W69-08035

THE UTILIZATION OF MUNICIPAL WASTEWATER IN JAPAN,
Ebara-Infilco Co., Tokyo (Japan).
Tetsuo Ide, Nobuo Matsumoto, and Hidenobu Arimitsu.
Water Reuse, Amer Inst Chem Eng Progr Symp, Ser 78, Vol 63, pp 46-53, 1967. 8 p, 14 fig, 3 tab, 16 ref.

Descriptors: *Water reuse, *Municipal wastes, *dustrial water, *Reclaimed water, Cooling wa Hardness (Water), Dissolved solids, Water qua Sewage treatment, Water sources, Costs, Turbic
Identifiers: *Japan, Tokyo.

The rapid progress of Japanese industry resulted in an increasing demand for water. C sequently, greater emphasis is beginning to placed on water conservation. As a poter method for water conservation, some of the ci in Japan have built large industrial water pl utilizing sewage plant effluent as the water sou and have supplied a colloidal matter-free effl to industries in the area. Suspended or collo matter is removed by coagulation with alumir sulfate or ferric chloride, followed by sedime tion and filtration. Retardation on chemical soft ing caused by phosphate in sewage plant effl can be overcome by the use of ferric chloride coagulant. (Knapp-USGS)
W69-08036

WATER REUSE IN ISRAEL,
Water Planning for Israel Ltd., Tel Aviv.
B. Caspi, Y. Zohar, and C. Salitemik.
Water Reuse, Amer Inst Chem Eng Progr Sy Ser No 78, Vol 63, pp 54-65, 1967. 12 p, 1 fi tab, 25 ref.

Descriptors: *Water reuse, *Reclaimed wa *Sewage treatment, Municipal wastes, Indust wastes, Water utilization, Water storage, Artifi recharge, Irrigation water, Industrial water, I nicipal water, Water conservation, Groundwa Aquifers, Water resources development, Costs.
Identifiers: *Israel.

Water scarcity in Israel has resulted in reuse 45,000 acre-ft/yr by 1965, and in planning reuse of 110,000 acre-ft/yr by 1970, includ reclamation for potable use by ponding, infil tion, and dilution of municipal wastewater: grea Tel Aviv, 80,000 acre-ft/yr; Jerusalem, 5,000 a ft/yr and of industrial wastewater: Hadera Pa Mills, 3,000 acre-ft/yr, and for unrestricted irr tion by biofiltration, complete disinfection, dilution of Greater Haifa municipal wastewa (7,000 acre-ft/yr). Problems are salinity, disin tion, ion exchange brine, and nitrogen remo Successes are development of highly-loaded po as a reliable treatment method, and planning seasonal underground storage. (Knapp-USGS)
W69-08037

CONSIDERATIONS ON THE REUSE WATER IN CERTAIN INDUSTRIES,
Centre Belge d'Etude et de Documentation Eaux (Liege).
E. H. T.H. Le Clerc.
Water Reuse, Amer Inst Chem Eng Progr Sy Ser No 78, Vol 63, pp 66-73, 1967. 8 p, 19 ref.

Descriptors: *Water reuse, *Sewage treatme *Reclaimed water, *Recirculated water, Indust wastes, Industrial water, Cooling water, Wa utilization, Pulp and paper industry, Steel, Su beets, Coal mines.
Identifiers: Industrial water recirculation.

Water reuse in the coal mining, sugar, steel, paper industries is discussed. In the steel indus once-through use of 80-200 cu m of water per of steel may be reduced by recirculation to 2.5-4 m per ton. Treatment consists of cooling removal of iron, cyanides, sulfur compounds, ides, and suspended solids. Coal mines use 100-4 cu m of waste water per ton of coal. Suspend solids and phenols must be removed both for re and before final disposal. Sugar refineries can re most of their processing water, which is a seri source of pollution when it is discharged untreat Processing of sugar requires 13-28 cu m per t Mud and organic materials must be removed reuse and before discharge. Paper making u about 100 cu m of water per ton of paper. The p cipal waste constituents to be removed suspended inorganic and organic solids and solved organic matter. (Knapp-USGS)

-08038

SERVATION OF WATER BY REUSE IN UNITED STATES,
nese Corp. of America, New York.
ert N. Rickles.
er Reuse, Amer Inst Chem Eng Progr Symp, No 78, Vol 63, pp 74-87, 1967. 14 p, 12 fig, 13 95 ref.

riptors: *Water reuse, *Reclaimed water, *Industrial water, Governments, Research and lopment, Water pollution control, Water recirion, Sewage treatment.
tifiers: FWPCA, Office of Saline Water.

er reuse in the chemical processing industries ie United States is discussed. Standards for r quality for cooling, boiler feed, petroleum ing, paper making, iron and steel making and industry use are listed. Treatments for reuse de settling, filtration, flocculation, oxidation, tion, activated sludge, distillation, freezing, ation, deionization, cooling, activated carbon, brane processes, and combinations of these ods. A bibliography of 95 papers on purificaof industrial waters is given. The activities of Office of Saline Waters and the Federal Water tion Control Administration in promoting r purification research are briefly outlined. (K-USGS)
-08039

TER RECLAMATION,
(Cyrus Wm.) and Co., Pittsburgh, Pa.; and egie-Mellon Univ., Pittsburgh, Pa.
ry C. Bramer, and Richard D. Hoak.
er Reuse, Amer Inst Chem Eng Progr Symp, No 78, Vol 63, pp 92-95, 1967. 4 p, 7 ref.

criptors: *Water reuse, *Reclaimed water, ter management (Applied), Recreation, Irriga- Multiple-purpose projects, Artificial recharge, strial water, Sewage treatment, Cooling, Recir- ted water.
tifiers: Water reclamation, FWPCA.

ent-day water reclamation in the United States ists principally of the use of treated municipal ewaters for recreation lakes, irrigation, ndwater recharge, and industrial purposes. treatment usually consists of primary settling, ndary treatment by activated sludge or in oxon ponds, and effluent chlorination. Although e are many instances of water reclamation g practiced in the United States today, the nitude of the water use involved is small. Ir as reclamation is a solution to problems of ly, the greatest potentials are in the arid ern states, where an expanding economy and a ward moving population will increasingly press n already limited supplies. Reclamation also, ever, presents an attractive alternative to simstream disposal of treated effluents, in many s from an economic standpoint even with uate freshwater supplies. Of particular sigance in the future is the increased economic ortance which recreational uses of the surface ers will have. (Knapp-USGS)
-08041

E MEDICAL PROFESSION'S ATTITUDE WARD WATER REUSE,
erican Medical Association, Chicago, Ill.
es G. Telfer.
er Reuse, Amer Inst Chem Eng Progr Symp, No 78, Vol 63, pp 101-105, 1967. 5 p, 20 ref.

criptors: *Water Reuse, *Psychological cts, Aesthetics, Attitudes, Decision making, ironmental engineering, Sewage treatment, irculated water, Municipal water.
tifiers: Medical profession attitudes.

sicians, a heterogeneous group, are vitally conied with life and environment, and especially water and its uses. They think of many cycles of water, in the body and in the environment. There are many kinds or reuse--of many kinds of water. Direct reuse in community drinking systems is a part of total environmental management. Medical societies are a good means of determining the medical profession's attitude and ought to be included in all phases of such reuse programs. The physician's attitude to reuse of treated sewage effluent is likely to be favorable when need is demonstrated. Medical societies should be consulted for help and criticism in any public water reclamation projects if the water is to be used for human consumption. (Knapp-USGS)
W69-08042

THE ROLE OF CHEMICALS IN WATER REUSE,
Aquacontrol, Inc., Houston, Tex.
M. C. Forbes, and P. A. Witt, Jr.
Water Reuse, Amer Inst Chem Eng Progr Symp, Ser No 78, Vol 63, pp 124-129, 1967. 6 p, 5 fig, 4 ref.

Descriptors: *Water reuse, *Sewage treatment, *Reclaimed water, *Recirculated water, *Water chemistry, Municipal wastes, Industrial wastes, Tertiary treatment, Water purification, Potable water, Pollution control, Costs, Water costs, Water quality control.
Identifiers: Waste treatment chemicals.

Pollution is expanding exponentially and grows as the second power of population. These 2 facts make the adoption of the zero effluent plant an absolute necessity sooner than we had expected. Purification processes are pollutional processes. The entropy analogy of pollution processes indicates that the role of chemicals will become a continuously declining one. The shift in economics will, on the other hand, dictate that chemical engineers a managers and technologists will become more and more involved in waste prevention. The success of the individuals, and the plants with which they are associated, will be closely related to their skills in this area. Regulation will change sharply, and will be supported by public demand based on the all too obvious effects of increasing population density. These facts will be a tremendous threat and source of loss to some, and a real opportunity for competitive advantage for those who can sense these changes and adapt in time. (Knapp-USGS)
W69-08045

VIRUS REMOVAL IN WATER REUSE TREATING PROCESSES,
Maine Univ., Orono.
Otis J. Sproul, Leo R. Larochelle, David R. Wentworth, and Robert T. Thorup.
Water Reuse, Amer Inst Chem Eng Progr Symp, Ser No 78, Vol 63, pp 130-136, 1967. 7 p, 2 fig, 6 tab, 24 ref.

Descriptors: *Water reuse, *Viruses, *Water purification, Filtration, Adsorption, Activated carbon, Biological treatment, Disinfection, Public health, Water treatment.
Identifiers: Virus removal.

The literature is reviewed for virus removal by primary and secondary treatment processes. The activated sludge process has been reported to yield removals of viruses in excess of 90%. Chlorination, as presently practiced, results in removals of only 90 to 99%. The adsorption of T2 bacteriophage on activated carbon from a secondary effluent was reversible and never exceeded 35% at low flow rates. Removals of Type 1 polio virus in excess of 90% were obtained in the lime precipitation of phosphate. (Knapp-USGS)
W69-08046

IONIZING RADIATION IN WATER REUSE,
Unidynamics/Phoenix, Ariz.
Hal R. Spragg, and Richard L. Curtin.
Water Reuse, Amer Inst Chem Eng Progr Symp, Ser No 78, Vol 63, pp 137-142, 1967. 6 p, 3 fig, 19 ref.

Descriptors: *Water reuse, *Water treatment, *Water purification, Ionization, *Radioactivity techniques, Oxidation, Sewage treatment, Chemical degradation, Tertiary treatment, Organic matter.
Identifiers: Ionizing radiation, Radiolysis, Gamma radiation.

The use of gamma radiation as a unit process has become firmly established in the past decade and is of significant potential value in amerliorating some of the present problems associated with the treatment of wastewater for reuse. Recent studies of the effects of radiation on domestic sewage showed that the sedimentation of suspended solids is significantly accelerated and that the radiolysis of dilute, aqueous systems of various contaminants results in products which are either less refractive to removal by conventional means or not objectionable as constituents of effluent water. The radio-oxidation of ammonia is analyzed as a model system. The costs of radiation have moderated significantly over the past few years. The principal expenditures required are for the treatment facility itself and for the radioactive material. Expenses for personnel training and facility maintenance are moderate to nominal. (Knapp-USGS)
W69-08047

PHOSPHATE REMOVAL BY ACTIVATED SLUDGE AT SAN ANTONIO, TEXAS,
Municipal Waste Water Treatment Plants, San Antonio, Tex.; and Texas Univ., Galveston. Medical Branch.
Don Vacker, C. H. Connell, and W. N. Wells.
Water Reuse, Amer Inst Chem Eng Progr Symp, Ser No 78, Vol 63, pp 148-158, 1967. 11 p, 9 fig, 11 tab, 13 ref.

Descriptors: *Sewage treatment, *Phosphates, *Activated sludge, *Adsorption, *Texas, Biodegradation, Biochemical oxygen demand.
Identifiers: Phosphate removal.

Phosphates are removed in municipal wastewater treatment plants in the aeration tanks by sorption to the activated sludge solids under proper operational conditions. Removal is necessary to prevent algae growths in streams receiving plant effluent. Dissolved oxygen, biochemical oxygen demand to activated sludge loading, mixed liquor suspended solids, ammonia, nitrate, and sludge volume index was studied. Effects of dissolved oxygen, desorption, variation in daily load, and phosphate in waste activated sludge were also studied. Effect of operational differences of three parallel plants are noted. Nonreturn of waste activated sludge degradation products is essential unless chemically treated. Future design and operation considerations are proposed. (Knapp-USGS)
W69-08048

PROBLEMS AND PRACTICE OF PHOSPHATE REMOVAL IN WATER REUSE,
Lawrence K. Cecil.
Water Reuse, Amer Inst Chem Eng Progr Symp, Ser No 78, Vol 63, pp 159-163, 1967. 5 p, 22 ref.

Descriptors: *Water reuse, *Sewage treatment, *Phosphates, Activated sludge, Adsorption, Biodegradation, Chemical precipitation, Waste water disposal.
Identifiers: *Phosphate removal.

The literature on phosphate removal for waste water reuse is reviewed. The operation of full-scale plants is compared with theory. Pilot plant studies show that phosphate can be removed effectively by adsorption on sludge, and that sludge may be treated to recover process reagents. (Knapp-USGS)
W69-08049

WATER RECLAMATION WITH GRANULAR ACTIVATED CARBON,
Pittsburgh Activated Carbon Co., Pa.; and Calgon Corp., Pittsburgh.
J. C. Cooper, and D. G. Hager.

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Water Reuse, Amer Inst Chem Eng Progr Symp, Ser No 78, Vol 63, pp 185-192, 1967. 8 p, 5 fig, 8 tab, 10 ref.

Descriptors: *Water reuse, *Water costs, *Desalination, *Sewage treatment, Costs, Optimization, Decision making, Cost-benefit analysis, Activated carbon, Tertiary treatment.
Identifiers: Desalination costs, Water reclamation costs.

The costs and efficiency of water reclamation by activated carbon are summarized and processing design parameters are tabulated for optimizing engineering decisions in reuse. The present state of activated carbon system development suggests that the process is immediately applicable to many municipal and industrial wastes for pollution abatement or for water reclamation. Municipal waste water reclamation could produce potable water at 16 cents per 1,000 gal at an investment of $33 million. This may be compared to the recent proposal to build a sea-water desalination plant in Southern California to supply 150 mgd at 23-30 cents per 1,000 gal at an investment of $300 million. (Knapp-USGS)
W69-08050

SUCCESSES AND FAILURES IN WATER REUSE,
Cosden Oil and Chemical Co., Big Spring, Tex.
Warden W. Mayes, and William E. Gibson.
Water Reuse, Amer Inst Chem Eng Progr Symp, Ser No 78, Vol 63, pp 197-200, 1967. 4 p, 2 fig, 1 tab, 3 ref.

Descriptors: *Water reuse, *Municipal wastes, *Reclaimed water, *Decision making, Oil industry, Cooling water, Costs, Water costs, Water quality, Water treatment, Sewage treatment.
Identifiers: Water reuse costs.

An oil refinery's experience with using reclaimed municipal waste water for 15 years is discussed and economic data are presented to aid in making decisions in the choice between using sewage effluents and other sources of poor-quality water. Foaming, corrosion, and excessive gypsum content of the water were the only major problems encountered. (Knapp-USGS)
W69-08051

HISTORY AND POSSIBLE FUTURE OF MULTIPLE REUSE OF SEWAGE EFFLUENT AT THE ODESSA, TEXAS INDUSTRIAL COMPLEX.
Aetron, Covina, Calif.; and El Paso Products Co., Odessa, Tex.
F. W. Kirkpatrick, Jr., and E. F. Smythe.
Water Reuse, Amer Inst Chem Eng Progr Symp, Ser No 78, Vol 63, pp 201, 209, 1967. 9 p, 3 fig, 1 tab, 2 ref.

Descriptors: *Water reuse, *Reclaimed water, Municipal wastes, *Recirculated water, *Oil industry, *Texas, Sewage treatment, Desalination, Water sources, Water management (Applied), Industrial water, Cooling water, Ion exchange, Water storage.
Identifiers: Odessa (Tex).

Present treatment to produce makeup to boilers and cooling towers from sewage effluent is shown by schematic flow diagram, and performance is indicated by water analyses. Operating experience with problems relating to sewage effluent storage, ion exchange resin beds, and calcium carbonate precipitation after lime treatment are discussed. Wastewater treatment and disposal by further use in oil field water flood operations is described. Examples of present reuse and some further potential reuses developed during a study by Aetron are presented. A possible future sewage treatment system and a system to maximize reuse by using a desalting process as suggested by the Aetron study are described. (Knapp-USGS)
W69-08052

REMOVAL OF NITROGENOUS COMPOUNDS FROM WASTEWATERS,
Carnegie-Mellon Univ., Pittsburgh, Pa.
William R. Samples.
Water Reuse, Amer Inst Chem Eng Progr Symp, Ser No 78, Vol 63, pp 223-229, 1967. 7 p, 1 fig, 35 ref.

Descriptors: *Waste water treatment, *Water reuse, *Nitrogen, Nitrogen compounds, Oxidation, Biodegradation, Nitrification, Denitrification, Nutrients, Tertiary treatment, Algae, Ammonia.
Identifiers: Nitrogen removal.

Normal treatment of our waterborne wastes has not in the past been concerned with removal of nitrogenous materials. In recent years, however, waste discharges containing compounds of nitrogen have been incriminated in the fertilization of streams and lakes, causing possible health hazards, and in general, causing a decrease in water quality for many uses. A review of many investigations into mechanisms for removal of nitrogenous materials in waste effluents is given. The mechanisms reviewed include both biological and chemical methods. Nitrogenous materials may be removed from waste effluents by any one of several methods. The most applicable at the present time appear to be denitrification, incorporation by algae, and ammonia stripping. The selection of the proper method for nitrogen removal in any particular case will depend on the local circumstances, including other treatments required, degree of nitrogen removal desired, chemical quality of the water, further uses for the water, and many others. The removal of nitrogen from effluents will be expensive but will by justifiable in an increasing number of instances. (Knapp-USGS)
W69-08053

A DESIGN PROCEDURE FOR BIOLOGICAL NITRIFICATION AND DENITRIFICATION,
Texas Univ., Austin.
W. Wesley Eckenfelder, Jr.
Water Reuse, Amer Inst Chem Eng Progr Symp, Ser No 78, Vol 63, pp 230-234, 1967. 5 p, 6 fig, 1 tab, 6 ref, append.

Descriptors: *Denitrification, *Biodegradation, *Water reuse, *Reclaimed water, Nitrogen compounds, Nitrogen, Ammonia, Nutrients, Biochemical oxygen demand, Tertiary treatment, Algae, Bacteria, Activated sludge.
Identifiers: Nitrogen removal.

The removal of nitrogen from sewage and industrial wastewaters is assuming increasing importance as the waste loadings from urban and industrialized areas increase. Unoxidized nitrogen exerts on oxygen demand on the receiving waters and oxidized nitrogen serves as a nutrient source for algal growth. It is possible to remove nitrogen by biological means by first oxidizing ammonia to nitrates followed by denitrification in which microorganisms reduce the nitrate to nitrogen gas. Studies which have been conducted on this process to date in laboratory, pilot-plant, and, to a limited extent, plant-scale investigations are reviewed. The theory of the process operation is developed from basic microbiological considerations. A design example for a sewage treatment plant is presented to illustrate the development of the process. (Knapp-USGS)
W69-08054

PROGRESS IN CONTROLLING ACID MINE WATER: A LITERATURE REVIEW,
Bureau of Mines, Pittsburgh, Pa. Coal Mining Research Center.
For primary bibliographic entry see Field 05G.
W69-08059

5E. Ultimate Disposal of Wastes

METHODS FOR THE STUDY OF HYDROGEOLOGICAL PARAMETERS OF UN-

DERGROUND STORAGE OF INDUSTR WATER DISCHARGES (RUSSIAN),
Moscow State Univ. (USSR).
V. M. Goldberg, S. M. Semenova, Ye. G. Chapovskiy, and V. M. Shestakov.
Razved i Okhrana, No 3, pp 41-46, Mar 1969. 2 tab.

Descriptors: *Hydrogeology, *Water pollut *Underground storage, *Sewage disposal, W reuse, Cost analysis, Industrial waste, Water an sis, Water purification, Pumping, Boreholes, ploitation, Chemical analysis, Temperat Permeability.
Identifiers: *Underground water storage.

After tracing briefly the development of derground storage techniques of polluted wate USSR and abroad (USA, France, etc.), the aut discuss the field and laboratory analyses of tinent characteristics of reservoir rocks and in trial waters whose preliminary knowledge is ne sary for efficient storage of polluted waters. main characteristics of the analysis are forecasting of pollution circulation and the ex and permeability of the layers under study. study shows that the utilization of natural e crust structures for storage of polluted wa necessitates the following preliminary steps: development of the methods capable of recog ing the presence of homogeneity characteristic water-bearing formations, also the polluted w circulation patterns; (2) the study of hydrodyn ics of interacting horizons; (3) development analytical basis for the quantitative evaluatio physico-chemical interaction taking place betw the pumped liquid and liquid content of rock mations; and (4) development of better technol in using boreholes in exploration and exploitat (Gabriel-USGS)
W69-08015

PROPOSED DELAWARE VALLEY INDUST AL WASTELINE - LEGAL IMPLICATIONS,
Franklin Inst. Research Labs., Philadelphia, Inst. for the Development of Riverine Estuarine Systems.
For primary bibliographic entry see Field 05G.
W69-08119

5F. Water Treatment and Quality Alteration

CONSERVATION OF WATER BY REUSE THE UNITED KINGDOM,
Water Research Association, Medmenham (gland); and Water Resource Board, Reading (gland).
For primary bibliographic entry see Field 05D.
W69-08032

WATER REUSE IN ISRAEL,
Water Planning for Israel Ltd., Tel Aviv.
For primary bibliographic entry see Field 05D.
W69-08037

THE MEDICAL PROFESSION'S ATTITU TOWARD WATER REUSE,
American Medical Association, Chicago, Ill.
For primary bibliographic entry see Field 05D.
W69-08042

VIRUS REMOVAL IN WATER REUSE TRE ING PROCESSES,
Maine Univ., Orono.
For primary bibliographic entry see Field 05D.
W69-08046

PERCEPTION AND PUBLIC POLICY IN T RECREATIONAL USE OF DOMESTIC WAT SUPPLY RESERVOIRS,
Southern Illinois Univ., Carbondale.
For primary bibliographic entry see Field 06B.

9-08060

. Water Quality Control

)UCTION OF RIVER HEAT POLLUTION TURBULENCE STIMULATION,
ramento State Coll., Calif. Dept. of Civil Engering; and Connecticut Univ., Storrs. Dept of l Engineering.
primary bibliographic entry see Field 05B.
)-07702

EMICAL EQUILIBRIA AND ZONING OF SURFACE WATER FROM JACHYMOV E DEPOSIT, CZECHOSLOVAKIA,
logical Survey of Czechoslovakia, Prague.
as Paces.
chim et Cosmochim Acta, Vol 33, No 5, pp 609, May 1969. 19 p, 6 fig, 6 tab, 23 ref.

criptors: *Water chemistry, *Mine water, mical potential, Aqueous solutions, Ions, tes, Equilibrium, Mineralogy. Sulfides, Oxida-reduction potential.
tifiers: Czechoslovakia.

er samples from the surface and from various erground levels of the Svornost mine, ymov, Czechoslovakia were analyzed. Eh and were measured in the field. The saturation in- s of water and carbon dioxide in the at- phere, the water-calcite system, the water-iron oxide system, and the water-pyrite system are n. Individual redox zones in the water body are istent with zones of secondary sulfide ore osition. Complexing of major ions, mineral e-relations, and temperature relations were sidered in the calculations. (Knapp-USGS)
)-07703

CURRENCE AND SIGNIFICANCE OF TICIDE RESIDUES IN WATER,
eral Water Pollution Control Administration, ens, Ga. Southeast Water Lab.
age Nicholson.
ash Acad Sci, Vol 59, No 4-5, pp 77-85, Apr- 1969. 9 p, 1 tab, 29 ref.

criptors: *Water pollution sources, *Water pol- n effects, *Pesticide residues, Fishkill, Pesti- kinetics, Water pollution control, Runoff, T, Dieldrin, Endrin, Chlorinated hydrocarbon icides, Organophosphorus pesticides.
tifiers: Pesticide pollution.

er pollution by insecticides has been a problem e the 1940's. Many of the synthetic pesticides very lethal to aquatic life, and fishkills and loss ie aquatic insects eaten by fish are common oc- ences. Sublethal concentrations of insecticides e high residual concentrations in fish; when the are eaten by birds, damage to the birds is a uent result. An agricultural watershed with 00 to 16,000 acres of cotton treated with 00 to 14,000 lbs of toxaphene, DDT, and BHC sampled. Insecticide concentrations were erally less than 1 microgram per liter in the r water, and insecticides were detected all year, just during the application season. DDT was om recovered from water because it was lly associated with stream sediment. Pesticide e discharges, accidents, and carelessness often taminate surface waters. Pesticide pollution trol depends on prevention of spills into waters upon user control of agricultural application to ent contamination of runoff. The use of the ly degrading chlorinated hydrocarbons should restricted and carefully regulated. (Knapp-GS).
)-07704

SURVEY OF HEAT SINK CAPACITY OF JOR STREAMS WITHIN THE U. S.,
elle-Northwest, Richland, Wash. Pacific thwest Lab.
primary bibliographic entry see Field 05B.
)-07720

WATER AND METROPOLITAN MAN,
American Society of Civil Engineers, Cambridge, Mass. Urban Hydrology Research Council.
For primary bibliographic entry see Field 06B.
W69-07722

A RECONNAISSANCE STUDY OF THE CHESAPEAKE BAY,
Regional Planning Council, Baltimore, Md.
Paul R. Farragut.
Reg Planning Counc, Baltimore, Md, Sept 1868. 90 p, 6 fig, 32 map, 25 ref, 2 append. Available from Clearinhouse as Pb 182 120 at $3.00 in paper copy and $0.65 in microfiche.

Descriptors: *Estuaries, *Maryland, *Water resources, *Water quality control, Water quality act, Standards, Governments, Regulation, Water pollution, Erosion, Eutrophication, Wetlands, Tides, Floods.
Identifiers: Chesapeake Bay (Md).

The problems of the Chesapeake Bay shoreline and of the waters of the bay are discussed. The physical problems discussed are erosion, sedimentation, flooding, eutrophication, polluted shellfish areas, thermal pollution, plant and animal nuisances, and the use of and damage to wetlands. Stream water quality is discussed with reference to Maryland's water quality standards. Agencies involved in water resources, hunting, fishing, and recreation are listed and their areas of responsibility are discussed. (Knapp-USGS)
W69-07742

DEVELOPMENT IN THE POOR NATIONS: HOW TO AVOID FOULING THE NEST,
For primary bibliographic entry see Field 06G.
W69-07773

EVALUATION OF THE PYRIDINE-ALKALI COLORIMETRIC METHOD FOR DETERMINATION OF ATRAZINE,
Wisconsin Univ., Madison. Dept. of Soils.
For primary bibliographic entry see Field 05A.
W69-07821

EFFECTS OF GAMMA RADIATION ON ACCUMULATION OF MINERAL NITROGEN IN FRESH SOILS,
United Kingdom Atomic Energy Authority, Wantage (England). Research Group.
P. A. Cawse.
J Sci Food Agric, Vol 19, pp 395-398, July 1968. 3 fig, 1 tab, 17 ref.

Descriptors: *Irradiation, *Gamma rays, *Nitrogen, *Soils, Sediments, Nitrogen compounds, Nitrification, Nitrogen cycle, Bacteria, Soil bacteria, Organic soils, Cycling nutrients, Radioecology.
Identifiers: Ammonium ions, Mineral nitrogen, Nitrifying bacteria.

Gamma-irradiated soils that had received 0.05 to 3 Mrad showed a significant increase in extractable nitrate-nitrogen. The response was greatest for the most organic soil. Perfusion of the soil with ammonium ions showed that rapid nitrification occurred after doses greater than 0.1 Mrad. This increase resulted from oxidation by non-proliferating cells of the nitrifying bacteria rather than from increased proliferation of the survivors. (Konrad-Wisc)
W69-07825

SOIL DEGRADATION OF DIAZINON, A PHOSPHOROTHIOATE INSECTICIDE,
Wisconsin Univ., Madison. Dept. of Soils.
For primary bibliographic entry see Field 05B.
W69-07867

LIMITATION OF NUTRIENTS AS A STEP IN ECOLOGICAL CONTROL,
Wisconsin Univ., Madison. Hydraulic Lab.; and Wisconsin Univ., Madison. Sanitary Lab.
For primary bibliographic entry see Field 05C.
W69-07869

STORAGE OF NATURAL OR ARTIFICIAL GAS AND PETROLEUM PRODUCTS IN PRINCE GEORGE'S COUNTY.
For primary bibliographic entry see Field 06E.
W69-07906

PESTICIDE RESIDUES IN SEDIMENTS OF THE LOWER MISSISSIPPI RIVER AND ITS TRIBUTARIES,
National Communicable Disease, Atlanta, Ga.; Food and Drug Administration, Washington, D. C.; Agricultural Research Service, Oxford, Miss. Sedimentation Lab.; and Agricultural Research Service, Gulfport, Miss. Plant Pest Control Div.
For primary bibliographic entry see Field 05B.
W69-07921

A SYSTEMS ENGINEERING APPROACH TO WATER QUALITY MANAGEMENT,
Kaiser Engineers, Oakland, Calif.
E. J. Stann, and R. J. Ringwood.
Civil Eng, Vol 39, No 6, pp 74-79, June 1969. 6 p, 4 fig.

Descriptors: *Planning, *Water pollution control, *Water resources development, *California, *Systems analysis, Estuaries, Model studies, Mathematical models, Optimization, Water management (Applied), Regional analysis, Water reuse, Tertiary treatment.
Identifiers: *San Francisco Bay area, Systems engineering.

The San Francisco Bay area has enough water, but much will be exported, thus reducing its waste-dilution capacity. An increasing amount of agricultural drainage is worsening the problem. A proposed region-wide solution, includes quality and effectiveness, cost feasibility, geo-economic influences, and social and esthetic requirements. Two new parameters of waste disposal and waste effects--toxicity and biostimulation--were employed. Three mathematical models of the area and system were used: a tidal hydrodynamic model, a dynamic water quality model, and a dispersion water quality model. Treatment and disposal facilities, should be constructed in 3 phases: Phase 1, 1970-1980, to convey effluents from problem areas where there is little waste dilution, toward the central Bay. Phase 2, 1980-1990, features a major ocean outfall and diffuser system, with wastes sent to the ocean getting advanced primary treatment, Phase 3, 1990-2020, essentially a planning guide, calls for regional reclamation of municipal wastewaters. The regional system is preferred over the present local-treat ment arrangement. The regional system is somewhat less costly. The study showed that the system engineering approach is essential in preparing a regional water management plan. (Knapp-USGS)
W69-07924

NATIONAL REFERENCE LIST OF WATER QUALITY STATIONS, WATER YEAR 1969.
Geological Survey, Washington, D. C.

Geol Surv Nat Ref List of Water Quality Sta, 1969. 693 p, 7 tab, index.

Descriptors: *Gaging stations, *Water quality, *Sampling, *United States, Data collections, Hydrologic data, Stream gages, Water year, Streamflow.
Identifiers: *Water quality stations.

Water quality stations operating in the U.S. in 1969 are listed. For each station, an identification number, latitude, longitude, station name, drainage

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area, state, county, date of initiation, type, discharge, type of record, and frequency of sampling are listed. Stations are summarized by state and territory, and sources of operating funds are listed. (Knapp-USGS)
W69-07941

ANIMAL WASTES--A NATIONAL PROBLEM,
Cornell Univ., Ithaca, N. Y. Dept. of Agriculture; and Cornell Univ., Ithaca, N. Y. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05B.
W69-08010

OIL SPILLAGE PREVENTION, CONTROL, AND RESTORATION-STATE OF THE ART AND RESEARCH NEEDS,
Battelle Memorial Inst., Richland, Wash.; and Hydronautics, Inc., Laurel, Md.
W. H. Swift, C. J. Touhill, W. L. Templeton, and D. P. Roseman.
J Water Pollut Contr Federation, Vol 41, No 3, Part 1, pp 392-412, Mar 1969. 21 p, 1 fig. Contract No TCG-15560-A (DOT-Coast Guard).

Descriptors: *Oily water, *Water pollution sources, *Ships, *Oil wastes, *Water pollution treatment, Water pollution control, Disasters, Industrial wastes, Shores, Aquatic life.
Identifiers: *Oil spill prevention and cleanup.

A review was made to evaluate the current state of technology of prevention and control of major oil spillage on water, the restoration of the shore face and waterfowl, and the effects of oil pollution and defensive measures on aquatic life. The study was made to assist in establishing procedures and facilities for standardized control and cleanup based on current technology and experience, and to show that additional research and development could result in improved capability for prevention, control, and restoration. Detailed research and development recommendations for prevention, control, and restoration are made. A plan of action which improves the capability for preventing and combating oil spillage and for minimizing its consequences is proposed. (Knapp-USGS)
W69-08014

CHLORINATED INSECTICIDES IN RUNOFF WATER AS AFFECTED BY CROP ROTATION,
Agricultural Research Service, Orono, Maine. Dept. of Plant and Soil Science; and Maine Univ., Orono. Water Resources Center.
For primary bibliographic entry see Field 05B.
W69-08028

WASTES IN RELATION TO AGRICULTURE AND FORESTRY,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 05C.
W69-08029

WATER RESOURCES AND THE LEGISLATIVE BRANCH,
Subcommittee on Air and Water Pollution (U. S. Congress).
Donald E. Nicoll.
Water Reuse, Amer Inst Chem Eng Progr Symp, Ser No 78, Vol 63, pp 88-91, 1967. 4 p.

Descriptors: *Water pollution control, *Water Quality Act, *Legislation, Water quality control, Waste treatment, Governments, Research and development, River basin development, Planning, Water resources development, Water law.
Identifiers: *Water Pollution Control Act, FWPCA.

Environmental contamination threatens to reduce available water supplies below demands. The Water Quality Act of 1965 upgraded the water pollution control program administration and established a water quality standards system for water resource planning, management, and improvement. The 1966 Water Pollution Control Act amendments increased Federal sewage treatment construction grants and increased grants for research and development of improved methods for industrial and municipal waste treatment. Next steps involve river basin planning and development, simplification of Federal grant programs, new control techniques, and better understanding of long-term pollution threats. (Knapp-USGS)
W69-08040

LEGAL ASPECTS OF WATER REUSE IN TEXAS,
Vinson, Elkins, Weems and Searls, Houston, Tex.
Victor W. Bouldin.
Water Reuse, Amer Inst Chem Eng Progr Symp, Ser No 78, Vol 63, pp 110-113, 1967. 4 p.

Descriptors: *Water law, *Texas, *Water reuse, Reclaimed water, Recirculated water, Legal aspects, Prior appropriation, Water transfer, Water management (Applied), Water rights, Water policy, Sewage treatment.
Identifiers: Texas Water Law.

The basic water laws in Texas are discussed, as well as the possibilities and liabilities in transfer of ownership of wastewater for subsequent reuse. Texas uses the system of prior appropriation rights to water. Depending on the water permit, water may be reused by the appropriator or may be sold for others' reuse. Each permit specifies the use the appropriator may make of the water and what portion of it must be returned. Limitations of rights include source, purpose, amount, point of diversion, point of return, description of land irrigated, and interbasin transfers. Contracts for reuse should specify rights, duties, obligations, and liabilities of all parties, the amount of water to be delivered, rates of delivery, periods of delivery, temperature, method of delivery, pressure, price, and disposition after reuse. (Knapp-USGS)
W69-08043

PROGRESS IN CONTROLLING ACID MINE WATER: A LITERATURE REVIEW,
Bureau of Mines, Pittsburgh, Pa. Coal Mining Research Center.
Walter C. Lorenz.
Bur Mines Inform Circ No 8080, 1962. 40 p, 11 fig, 2 tab, 207 ref.

Descriptors: *Acid mine water, *Water pollution control, *Reviews, Water pollution sources, Bibliographies, Sulfates, Acid bacteria, Mine drainage.
Identifiers: Acid mine drainage control.

Literature on the control of acid mine drainage published before 1962 is reviewed. A bibliography of 207 entries is included. The topics reviewed are sources of pollution, neutralization of acid mine water, mine sealing, inhibition of acid formation, and drainage control. (Knapp-USGS)
W69-08059

OPTIMIZATION OF A CLASS OF RIVER AERATION PROBLEMS BY THE USE OF MULTIVARIABLE DISTRIBUTED PARAMETER CONTROL THEORY,
Western Electric Co., Inc., Princeton, N. J. Engineering Research Center; Newark Coll. of Engineering, N. J.; and Rutgers - The State Univ., New Brunswick, N. J.
Victor J. Tarassov, Harlan J. Perlis, and Burton Davidson.
Water Resources Research, Vol 5, No 3, pp 563-573, June 1969. 11 p, 9 fig, 2 tab, 19 ref.

Descriptors: *Aeration, *Water pollution, Linear programming, Dynamic programming, Costs.
Identifiers: *Control theory, Pontryagin's Maximum Principle, Streeter-Phelps system equations, Objective function, Optimal control, Multivariable system.

Mathematical programming methods applied water pollution problems have been highly succe ful, especially in cases where hypothetical mod were used. In many applications, linear p gramming, dynamic programming, or Pontryagi Maximum Principle methods have been dem strated using steady state Streeter-Phelps syst equations at some stage in the optimization stu The authors propose to examine the application the Sirazetdinov-Tarassov-Perlis theory of optir control to the artificial in-stream aeration probl in polluted rivers. The main concern of the study to show how artificial in-stream aeration can controlled so as to minimize the relative cost operation for several competing design crite The economic aspects of cost minimization of t process has important theoretical implications a potential applications to specific water polluti problems. (Loeb-Rutgers)
W69-08061

STREAMS, RIVERS AND LAKES: POLLUTI PROBLEMS,
Syracuse Univ., N. Y.
Nelson L. Nemerow.
The Rresh Water of New York State: Its Conser tion and Use, pp 30-33, Wm C Brown Book C Dubuque, Iowa, 1967. 4 p, 1 disc. Edited by Laur B. Hitchcock.

Descriptors: *Streams, *Rivers, *Lakes, *Wa pollution, River basins, Wastes, Water quality, C ganic matter, Salts, COLOR, Turbidity, Heat, C Bacteria, Protozoa, Viruses, Acids, Alkalis, Pric Water allocation, Odor.
Identifiers: Economic worth, Toxic matt Suspended solids, Radioactive matter, Grease, S face, Active matter, Odoriferous matter.

A state of stream pollution is defined to exist wh excessive contamination interferes with the use water as a resource. Fourteen typical examples contaminants are given. Contemporary proble are described for each of these contaminants. T writer attempts to relate the past and pres emphasis is on stream pollution to the future sit tions which we face. The writer believes that system of equitable allocation of stream polluti capacity will be vital to future pollution abateme programs. The system should be based upon t economic worth of the resource as well as the s jective desires of the local river basin communi Several challenging technical problems are a presented. (See W69-08076). (Loeb-Rutgers)
W69-08078

ECONOMY OF WATER QUALITY MANAG MENT AND POLLUTION CONTROL,
Federal Water Pollution Control Administrati Washington, D. C.
James J. Plannery.
The Fresh Water of New York State: Its Conser tion and Use, pp 51-57, Wm C Brown Book C Dubuque, Iowa, 1967. 7 p. Edited by Lauren Hitchcock.

Descriptors: *Water quality, *Energy, *Conser tion, *Water pollution control, *Waste dispos Fishing recreation, Water treatment, Cos Benefits.
Identifiers: *Water quality management, Pub water, Least-cost alternatives.

This paper describes the dimensions of the wa pollution problem; indicating the sources, t kinds, the effects, and the magnitudes of pollutio so far as they are known. The economic aspects pollution are based on the conflicts between wa disposal and other uses of the public waters. T greatest conflict is with the uses that take place the public waters themselves -- fishing, recreatio and aesthetics. The withdrawal uses are also fected but those effects may be corrected by wa treatment. An optimum arrangement among us including waste disposal, can be determined analyzing incremental costs and benefits or by c culating the benefit and cost variations among d ferent least-cost alternatives. Furthermore, t

er says that requiring waste disposers to pay in portion to their use of the public waters for osal probably would facilitate the optimization cess considerably, for it would cause the waste osers to be cost-conscious to the extent that would reduce wastes to save money. Intensive y of the idea is urged. (See W69-08076). eb-Rutgers)
9-08079

POSED DELAWARE VALLEY INDUSTRI-WASTELINE - LEGAL IMPLICATIONS,
nklin Inst. Research Labs., Philadelphia, Pa. for the Development of Riverine and arine Systems.
F. Murphy, and Ruth L. Kovnat.
ES Information Center Report No 1, April 9. 30 p, 48 ref. Pa. 29-Grant GA-4468 F P.

criptors: *Legal aspects, *Waste water osal, *Pipelines, Industrial wastes, Jurisdiction, of the sea, Continental Shelf.
tifiers: Ocean disposal.

rnational, federal, and state (Pennsylvania, Jersey, and Delaware) laws that might have a ing on the establishment and operation of the aware Valley Industrial Wasteline were ewed to identify any areas of potential legal flict affecting its institution so that appropriate s could be taken to forestall these conflicts. ause the proposed wasteline will collect con-trated effluents from industries along the aware River from Trenton to just south of adelphia and transport them through a pumped line across southern New Jersey for disposal ond the Continental Shelf break, there is no that this wasteline can avoid scrutiny by the aware River Basin Commission, the Depart-t of the Interior, and the Department of State, far as other nation-states might object to the teline's outfall in the ocean. Three types of or-zation were studied to determine which would he best form for the implementation of the teline from a legal and political point-of-view: a public utility; (2) an interstate authority (a lic authority); and (3) a Federal authority, that ne similar to the Tennessee Valley Authority. the basis of the analysis of existing statutes and the hope of coordinating as many of the in-sted parties as possible, the public authority n of organization is recommended. It is con-ded that if the Delaware Valley Industrial steline is shown to be technically feasible and if demonstrated that this kind of pipeline can liorate the pollution problems of inland waters out adversely affecting the oceans, legal bar-s to its institution are surmountable. The report tains a bibliography of 48 references, most of ch are annotated. (Devlin-Franklin Institute)
9-08119

ME DATA ON DIFFUSION AND TURBU-NCE IN RELATION TO REAERATION,
ois Univ., Urbana. Water Resources Center.
. Holley.
earch Report No 21, Water Resources Center, versity of Illinois July, 1969, iii+ 53 pp, 13 fig, ef. OWRR Project A-021-ILL.

criptors: *Reaeration, *Dissolved oxygen, Dif-on, Turbulence.

t was used as a tracer to determine diffusion s immediately below the free surface both in 'film' region and in the remainder of the water mixing vessel. The results tend to indicate that iffusion model can be used to represent the nward transport of a substance which is being orbed at the free surface. Apparently, the diffu-coefficient in the 'film' can be either equal to greater than the molecular coefficient depend-on the amount of mixing at the free surface. Hot anemometry was used to determine turbulence racteristics from 1 in. to 0.006 in. below the surface of a laboratory open channel flow. The rgy spectra indicate no significant changes in the turbulence in this region. Thus, apparently turbulence exists to the free surface and in the 'film' region.
W69-08126

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

COMPUTER AIDED DESIGN OF WASTE WATER COLLECTION AND TREATMENT SYSTEMS,
Michigan Univ., Ann Arbor. Dept. of Environmental Health.
For primary bibliographic entry see Field 05D.
W69-07714

A TEST SIMULATION OF POTENTIAL EFFECTS OF THERMAL POWER PLANTS ON STREAMS IN THE UPPER MISSISSIPPI RIVER BASIN,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
For primary bibliographic entry see Field 05B.
W69-07738

PERT SIMULATION: A DYNAMIC APPROACH TO THE PERT TECHNIQUE,
Oregon State Univ., Corvallis; and Foamat Foods Corp., Corvallis, Oreg.
For primary bibliographic entry see Field 07C.
W69-07775

THE CONCEPTUAL FORMULATION AND MATHEMATICAL SOLUTION OF PRACTICAL PROBLEMS IN POPULATION INPUT-OUTPUT DYNAMICS,
Department of Agriculture, Ottawa (Canada). Statistical Research Services.
For primary bibliographic entry see Field 06G.
W69-07816

A SYSTEMS ENGINEERING APPROACH TO WATER QUALITY MANAGEMENT,
Kaiser Engineers, Oakland, Calif.
For primary bibliographic entry see Field 05G.
W69-07924

OPTIMIZATION OF A CLASS OF RIVER AERATION PROBLEMS BY THE USE OF MULTIVARIABLE DISTRIBUTED PARAMETER CONTROL THEORY,
Western Electric Co., Inc., Princeton, N. J. Engineering Research Center; Newark Coll. of Engineering, N. J.; and Rutgers - The State Univ., New Brunswick, N. J.
For primary bibliographic entry see Field 05G.
W69-08061

A STOCHASTIC MODEL OF MONTHLY RESERVOIR STORAGE,
City Univ., London (England).
For primary bibliographic entry see Field 04A.
W69-08062

6B. Evaluation Process

WATER AND METROPOLITAN MAN,
American Society of Civil Engineers, Cambridge, Mass. Urban Hydrology Research Council.
Stifel W. Jens, and D. Earl Jones, Jr.
Rep of 2nd Eng Found Conf on Urban Water Resources Res, Aug 12-16, 1968, Andover, N H, 1969. 90 p, 4 append.

Descriptors: *Water resources development, *Planning, *Urbanization, Systems analysis, Mathematical models, Social aspects, Legal aspects, Economics, Management, Water management (Applied).
Identifiers: Water resources research, Sociology.

The second conference on urban water resources research stressed the interdisciplinary and systems analysis approaches to solving urban water and pollution problems. Recommendations were made for action and for further research in communication, planning, social impacts, regulation, data collection, precipitation, storage, urban design, and systems analysis. (Knapp-USGS)
W69-07722

THE CHANGING VIEWPOINTS OF WATER RESOURCES PLANNING,
Board of Engineers for Rivers and Harbors, Washington, D. C.
Vernon L. Kimball.
Prepr 772, Amer Soc Civ Eng Annu Meet Nat Meet Water Resour Eng, New Orleans, La, Feb 1969. 27 p, 9 ref, append.

Descriptors: *Water resources, Project planning, Planning, *Attitudes, Social aspects, Decision making, Federal Government, State Governments, Local governments, Economics, Economic feasibility, Forecasting, Social values, Benefits.
Identifiers: *Regional planning, Regional authorities, Federal-State Cooperation, Appalachian Redevelop Act 1965.

Water resources planning is becoming more and more an intergovernmental effort including Federal, state, and local governments. Coordinating water resources planning with urban planning is becoming increasingly necessary. The regional type of planning authority will become more prevalent; the planner will be required to deal with factors other than water resources. This type of planning authority should build greater political acceptability into comprehensive water resource development plans. To meet the needs of future growth and improve the present environment, full use of our resources will be required. An increasing trend toward decentralization of water resources planning is evident. The past centralizing tendency at the Federal level is being reversed gradually by delegating authority to lower levels through greater use of Federal grants and other aid devices and through river basin commissions and regional authorities. The Federal planner will retain his responsible senior role under most of these new concepts. The best prescription for the planner is to recommend initial plans based on sound facts and professional judgment. Subsequently, he must follow closely a feedback process and revise his plans accordingly. (USBR)
W69-07783

SHOULD THE ENGINEER HAVE THE LEADING ROLE IN WATER RESOURCES PLANNING,
Minnesota Univ., Minneapolis.
Edward Silberman.
Prepr 803, Amer Soc Civ Eng Annu Meet Nat Meet Water Resour Eng, New Orleans, La, Feb 1969. 12 p, 9 ref.

Descriptors: Engineering, *Engineering personnel, *Leadership, *Water resources, Decision making, *Planning, Projects, Benefits, Professional personnel, Consulting engineers, Natural resources, Public opinion, Water resources development.
Identifiers: Cooperation.

The engineer must work as part of a water resources planning team with members of other disciplines (biologists, ecologists, and conservationists), as well as sportsmen in the planning process. As to who should lead the team, the answer does not lie in stating categorically that the engineer or any other specialist should be the leader. The leader is the man who can weld together successfully the many interests bearing on the problem under study. He must recognize what

IOWA U. OF L. URBAN-CHAMPAIGN

the various interests are, and select effective representatives for each. The engineer should be a primary candidate because technical engineering problems are still the major problems in water resources development. The public recognizes that the engineer has a long history and much experience in leading such projects. The well-trained engineer is better qualified than practioners of most other disciplines to advise the planning group and public that every improvement has its cost and to state the relationship between the benefits and costs, even if they cannot be measured entirely in money. Although the leader frequently must play the role of mediator, he must not be a passive mediator if timely solutions for water resources problems are to be achieved. (USBR)
W69-07786

REAL COSTS AND REAL BENEFITS UNDER PRESENT FEDERAL WATER RESOURCES EVALUATION PROCEDURES,
Manitoba Univ., Winnipeg.
Gunter Schramm.
Pap, Eighth Annu Meet, Western Reg Sci Ass, Los Angeles, Calif, Feb 1969. 23 p, 2 fig, 3 tab, 18 ref, append.

Descriptors: *Real costs, *Real benefits, *Evaluation, Project planning, Economics, Benefit-cost ratios, Benefits, Prices, Projects, Hydroelectric power, Hydroelectric plants, Thermal powerplants, Alaska, *Economic feasibility, Capital costs, Inflation (Economic), Economic prediction, Water resources, Bibliographies, *Federal Project Policy.
Identifiers: Benefit-cost analysis, Rampart Dam (Alaska), Cost indexes, Yukon-Taiya Proj (Alaska).

The practice of using current rather than expected future price relationships in evaluating potential Alaskan hydropower developments is examined. The prevailing practice of evaluating benefits and costs in terms of present costs and prices may not only lead to an understatement of actual costs, but also may lead to gross inefficiencies in project selection. This danger is particularly great in cases of hydro projects with long-term project sequences depending on some common facility for their feasibility. While the need to estimate future price relationships may introduce new uncertainties into project evaluations, the use of prevailing prices is even less satisfactory. A somewhat inaccurate estimate of future changes backed up by a sensitivity analysis testing the effects of the assumptions on overall benefits and costs will provide a more realistic picture. This issue is important since the traditional cost advantage of hydro over thermal alternatives is disappearing. With dramatic cost reductions expected from future atomic powerplants, power system planners must take these expected changes explicitly into account. (USBR)
W69-07789

THE ECONOMICS OF AN UPPER YUKON BASIN POWER DEVELOPMENT SCHEME,
Manitoba Univ., Winnipeg.
Gunter Schramm.
Ann Reg Sci, Vol 2, No 2, pp 214-228, Dec 1968. 15 p, 3 fig, 3 tab, 22 ref.

Descriptors: Project planning, *Project feasibility, Economics, Electric power, Electric power production, Feasibility studies, Electric power costs, Electric power demand, *Hydroelectric power, Capital costs, Water resources development, Diversion tunnels, Alaska, Hydroelectric plants.
Identifiers: *International cooperation, *Yukon River, Alaska, Canada, *International projects, British Columbia, Canada, Taiya Valley (Alaska).

Since 1947, several investigations aimed at harnessing the power potential of the Upper Yukon by diverting headwaters through the coastal mountains have been conducted. Such diversion schemes appear attractive because the headwaters form a series of lakes at elevations of 2000 ft, less than 20 air miles from low-lying coastal river valleys. Three development proposals would divert water to the Taiya Valley in Alaska, and one proposal would divert water to the Taku River in British Columbia. Cooperation of the U S and Canada in developing the Yukon-Taiya Project could lead not only to a least-cost solution in engineering terms, but also to a least-cost solution in economic terms. Full advantage could be taken of the existing differential in labor and capital costs. Without cooperation, developing the project does not appear feasible; with cooperation, both countries could possibly obtain a source of energy priced low enough to be competitive. Availability of very low-priced at-site power would be conducive to economic development in southeastern Alaska and in the adjacent, mineral-rich areas of the Yukon and British Columbia. (USBR)
W69-07800

INSTITUTIONAL CONSTRAINTS ON THE DEVELOPMENT OF A REGIONAL WATER SUPPLY SYSTEM: THE CASE OF DETROIT,
Norman Wengert, and George M. Walker, Jr.
Fourth American Water Resources Conference, American Water Resources Association, New York City, November 1968. 19 pp.

Descriptors: *Institutional constraints, *Water supply, Regional analysis, Administrative agencies, Economies of scale, Decision-making.
Identifiers: *Detroit (Mich), *Regional system.

Detroit has had a regional water supply system since 1969. Its purpose was to enact a program which would realize economies of scale for the region resulting from a large integrated water supply system, which would include areas outside the corporate limits. Significant institutional constraints developed which effected the pattern of regional development. The three functions of the water utilities accounting are shared by the Detroit Metropolitan Water System and local governments. Production and transmission are handled by Detroit Metropolitan Water System while distribution is handled by local governments. Two limiting factors have effected the efficiency of this separation of function: (1) The definition of distribution service areas is arbitrary, hence removed from a consideration of regional efficiency factors with equal discrepancies in organizational administrative arrangements, and (2) there is dispersal of control over rates paid by the ultimate consumers. Separation of functions has brought intergovernmental politics and administration to the fore in Detroit Metropolitan Water System and has made it vulnerable to a variety of pressures. In some cases regional efficiency and fairness is sacrificed in an attempt to deal with local governments. A case study of Flint is given as an example of the kinds of negotiations and issues involved in building the regional system. (Marriott-Chicago)
W69-07871

FIFTH WATER RESOURCES PROGRAM.
Delaware River Basin Commission, Trenton, N. J.

Delaware River Basin Commission, Trenton, New Jersey, March 1968. 153 pp, 17 fig, 31 tab, 93 ref, 6 append.

Descriptors: *Water supply, *Water demand, *Delaware River Basin Commission, Water management programs, Applied projects, Underground streams, Surface waters, Water transfer, Recreation facilities, Electric power production, Navigation, Flood control, Water quality control, Non-structural alternatives, Withdrawal, Wildlife, Fish.
Identifiers: *Delaware River Basin.

The report discusses prospective needs for water and related resources in the Delaware River Basin through the year 2010. It identifies the areas of need and proposes construction or development of projects that will be required in the next six years for the optimum development and utilization of the Basin's water resources. Chapter I summarizes findings, draws conclusions, and recommends t the Commission complete specific projects and dies and continue to endorse early acquisition lands needed for future projects. Chapter II c siders the effects of location, quantity, quality, time on water supply. It analyzes undergro sources and surface streams, and considers the fects of importation and exportation on sup Chapter III discusses available water-rela resources, including natural and improved facil for recreation, electric power generation, navi tion, flood control, and water-quality cont Chapter IV discusses demands for w withdrawals, instream water demands, and mands for related products and services. Chapte establishes the need for water resources mana ment. It discusses increasing withdrawal dema flood control, power, recreation, fish, and wild water-quality control, and specific needs in e sub-basin. Chapter VI recommends projects programs for Commission endorsement, highlights the need for non-structural programs flood-loss reduction. (Gossen-Chicago)
W69-07872

WATER RESOURCE DEVELOPMENT CALIFORNIA: THE COMPARATIVE EF CIENCY OF LOCAL, STATE, AND FEDER AGENCIES,
Resources for the Future, Inc., Washington, D. C
Joe S. Bain.
For main entry see Vol 1, No. 12, Field 6B, W 05115. In Water Research, Johns Hopkins Pr Baltimore, 1966, pp 51-67. 5 tab, 2 ref.

Descriptors: *Economic efficiency, *Inter-age cooperation, California, Water resources devel ment, Central Valley Project, Federal jurisdicti State jurisdiction, Marginal benefits, Water tribution (Applied), Cost-benefit analysis.
Identifiers: Feather River Project, Local juris tion.

There are two spheres of water developers California's Central Valley: local public agenc and federal and state producer-wholesalers. T have little interdependence. Federal-state agenc have some inherent advantages but encounte the disadvantages of being later developers. C sified economically, opportunities available federal and state agencies were: (a) numerous m ginal or submarginal opportunities for independ action; (b) a few better opportunities for augme ing local developments of rivers, which were c plicated by tangled water rights situations; and even fewer better opportunities which local ag cies had by-passed because of expense. The spheres are separately analyzed for: the level development; the character of water allocat among types, sites, and times of use; and allocat among different users of given types. In eighteen rigation districts administered by local agenc average revenue was appreciably below long- average cost. These districts have either over- located water for their own lands or maldistribu water among irrigators. Benefit-cost analyses of basic features of the Central Valley Project, the Feather River Project show that the federal state projects are equally inefficient as local p jects. (Gossen-Chicago)
W69-07873

POLITICS AND EFFICIENCY IN WAT DEVELOPMENT,
Resources for the Future, Inc., Washington, D. C
Hubert Marshall.
For main entry see Vol. 2, No. 12, Field 6B, W 05115. In Water Research, Johns Hopkins Pr Baltimore, 1966, pp 291-310. 24 ref.

Descriptors: *Ethics, Decision making, Politi aspects, Economic justification, Economic effici cy, Appropriation, Social aspects, Professional p sonnel, Professional societies, Engineering edu tion.
Identifiers: *Professionalization, U.S. Congr President of U.S.A., Army Corps of Engineers,

of Reclamation, Soil Conservation, Organizational structure.

report examines the procedures used by construction agencies–the Corps of Engineers, the Bu of Reclamation, and the Soil Conservation vice--to justify projects and secure appropria-s. It is concluded from a substantial body of ature that the economic-efficiency justifica-s of projects have either inflated benefits or ated costs. The distortion is well-known in Con-s, but ignored because of constituency de-ds for public works. The President could cor- the distortion by changing the economic-uation criteria embodied in Senate Document but political costs make such an action unlikely. hin the construction agencies, group forces ntain cost-benefit distortions. The report ommends professionalization in decision-mak- Professionalization has four characteristics: criticism comes from colleagues of the same ing rather than a lay superior; (2) profes-als have no personal interest that would in-nce their decisions; (3) professions are oriented ard community interest; (4) professions instill heir members ethical codes. Engineers are essionals but make little resistance to distorted efit-cost ratios for three reasons: (1) a definite y of professional knowledge is not yet blished; (2) engineers receive inadequate train-in economics; (3) agency personnel find little icit moral guidance in the Code of Ethics of the erican Society of Civil Engineers. (Gossen-cago)
9-07876

JOR RESEARCH PROBLEMS IN THE SO-L SCIENCES,
ources for the Future, Inc., Washington, D. C.
hen C. Smith.
main entry, see Vol. 2, No. 12, Field 6B, W69-15. In Water Research, Johns Hopkins Press, imore, 1966, pp 503-508. 3 ref.

criptors: *Research and development, *Water urces development, Organizations, Decision ing, Social aspects, Social participation, Invest-t, Optimization, Water utilization, Political ects, Water law.
tifiers: *Social sciences.

article identifies several topics for research. A or never-ending task is to identify significant ems and subsystems of organized social action reference to water resources, and to un-tand the dynamics and interaction of these ems. A specific problem is the jump between eria evaluation and hard decision. Fundamental ti-discipline studies in identifying appropriate sion systems in which evaluative criteria can ction are recommended. The social role of er in public and private behavior must be ified, because two conflicting concepts of water elopment exist. The one used is 'Governments st to remove water as a constraint to private elopment.' The one desired is 'We seek an nomically optimal water resource allocation in region x and time y.' The sociologist should pt the spread of 'practices research' to water in order that water shortage may be offset by cient use. Questions of social organization and handling of conflict deserve attention. Power tionships among the political entities associated water resources must be studied. Water law t be ordered. Non-monetary criteria must be er defined. All research should be carried to operational stage where possible. (Gossen-cago)
9-07877

ASTAL WATERS AND THE NATION,
ional Council on Marine Resources and En-ering Development, Washington, D. C.
ard Wenk, Jr.
il Eng, Vol 39, No 6, pp 52-55, June 1969. 4 p.

Descriptors: *Planning, *Land use, Coasts, *Coastal marshes, *Beaches, Coastal plains, Recreation, Industries, Fishing, Agriculture, Management, Land resources, Urbanization, Governments, Water pollution.
Identifiers: Coastal land uses, Land use planning.

The states in the U.S. Coastal Zone contain most of the nation's population and industry, the gateway for maritime trade of about $40 billion, the staging area for the $500 million fish and crustacean industry, and the locus for the billion-dollar offshore oil and gas industry. The task is to balance 2 factors--demands for development and more subtle esthetic natural-resource and recreational needs. Each year, tens of millions of people turn to the sea for recreation. The zone as a resource is shrinking and subject to degradation: a site of marshlands ready for filling, a convenient sink for wastes (already 10% of the coastal waters are lost for shellfish culture, because of pollution), the site of an oil-tanker wreck and a runaway underwater oil well. The need is for planning--rational weighing of the demands for development against the values obtained by preservation. The Federal Government is attacking the problem by undertaking studies and by considering merits of the idea of state managed Coastal Zone Authorities to plan and regulate land and water use. The states have the lead role as they now have the legal jurisdiction over most coastal resources, but need better coordinated and stronger agencies as well as more aggressive action. (Knapp-USGS)
W69-07923

WATER AND CHOICE IN THE COLORADO BASIN,
National Academy of Sciences, Washington, D. C.
For primary bibliographic entry see Field 06D.
W69-07925

MINERAL RESOURCES OF THE WORLD OCEAN.
Geological Survey, Washington, D. C.; Rhode Island Univ., Newport; and Department of the Navy, Washington, D. C.

Keiffer, Elisabeth, Editor. Proc Symp on Mineral Resources of World Ocean, Rhode Island Univ Nav War Coll, July 11-12, 1968, Newport, 1968. 108 p, 40 fig, 5 plate, 2 tab, 108 ref. N00014-68-C-0439 (NR083-240).

Descriptors: *Conferences, *Oceans, *Continental shelf, *Political aspects, Sea Water, Marine geology, Continental slope, Mineral industry, Natural resources, Technology, Engineering, Resource development.
Identifiers: *Symposium, *Marine mineral resources, Policy considerations.

Presents 15 papers and comments resulting from the first conference of its kind. Co-sponsored by the U.S. Geological Survey, the University of Rhode Island, and the Navy, the meeting brought together representatives from science, industry, government and the military to discuss the ocean environment and the problems and possibilities in recovery of mineral resources from the ocean. The symposium was divided into 4 parts: Ocean-geologic Times, Mineral Resources, New Technology and Engineering in the Oceans, and Public Policy Questions. Included in the Proceedings are reports on marine geology of continental shelves and slopes; mineral potential including petroleum, tin, and seawater as a raw material; problems in developing minerals; and national and international considerations relating to ocean mineral resources. (Lang-USGS)
W69-07973

FUTURE WATER SUPPLY-FACILITIES, METROPOLITAN WASHINGTON REGION,
Metropolitan Washington Council of Governments, D. C. Board of Engineers.
Richard Hazen, Thomas M. Niles, Roy H. Ritter, and Abel Wolman.
Available from Clearinghouse as PB 182 307 at $3.00 in paper copy and $0.65 in microfiche. Metrop Wash Counc Governments, Board of Eng Rep No 2, Dec 1968. 74 p, 6 fig, 11 tab.

Descriptors: *Water demand, *Water supply, *Water sources, *Water distribution (Applied), *District of Columbia, Virginia, Maryland, Networks, Water sources, Water conveyance, Water delivery, Water management (Applied), Water works, Public utilities.
Identifiers: Washington D. C. Metropolitan area.

Beginning with the assumption that the recommendations presented in Report No. 1 dated May, 1967 will result in development of an adequate supply of raw water to the Region, Report No. 2 estimates the quantities of water that will be required by the various systems serving the Washington Metropolitan Region to 2010. It makes general recommendations concerning the facilities needed to meet those developing water requirements. Existing facilities of the systems are surveyed, and individual chapters are devoted to the District of Columbia, the Washington Suburban Sanitary District (Montgomery and Prince George Counties in Maryland) and the Fairfax County (Virginia) Water Authority, the three systems that supply 95 percent of the water. Attention is devoted to the need for emergency interconnections among the systems and to the extension of Washington Aqueduct service to some of the Virginia systems. Matters of organization and finance are also discussed. (Knapp-USGS)
W69-08024

PERCEPTION AND PUBLIC POLICY IN THE RECREATIONAL USE OF DOMESTIC WATER SUPPLY RESERVOIRS,
Southern Illinois Univ., Carbondale.
Duane D. Baumann.
Water Resources Research, Vol 5, No 3, pp 543-554, June 1969. 12 p, 4 fig, 2 tab, 31 ref.

Descriptors: *Recreation, *Domestic water, *Water supply, Reservoirs, Water management, Management, Diseases, Environmental sanitation, Legal aspects, Northeast US, Epidemics.
Identifiers: *Managerial perception, *Water pollution, *Public policy, *Recreational use, *Water managers, Consumer, Recreational activities, Social guides.

In the Northeast and Far West, recreational activities are usually prohibited from domestic water supply reservoirs. Water managers perceive recreation to be incompatible with the production of safe, potable water. Public attitudes are opposed to such reservoir use and the state health departments are influential in the formation and perpetuation of the restrictive policies and laws of recreation on domestic water supply reservoirs. In the remainder of the country, recreational activities are not only allowed on domestic water supply reservoirs, but the water managers do not consider reservoir recreation as inimical to the hygienic and aesthetic qualities of the drinking water. The public favors such reservoir use. Within each region, managerial perceptions of recreation on municipal water supply reservoirs were demonstrated to be a function of the manager's evaluation of water treatment technology, recreation as a source of pollution, managerial problems, and the economics of providing recreation. These in turn were influenced by the formal and informal social guides. From a literature review, the writer concludes that all recreational activities can be permitted on domestic water supply reservoirs without any measurable increase in the risk of water-borne disease if the water is properly treated. (Loeb-Rutgers)
W69-08060

CLASSIFICATORY NOTES ON THE PRODUCTION AND TRANSMISSION OF TECHNOLOGICAL KNOWLEDGE,
Harvard Univ., Cambridge, Mass.
Kenneth J. Arrow.
American Economic Review, Vol 59, No 2, pp 29-35, May 1969. 7 p, 12 ref.

LIBRARY U. OF I., URBANA-CHAMPAIGN

Descriptors: Resource development, Technology, Risks.
Identifiers: *Production of knowledge, *Transmission of knowledge, *Technological knowledge, Production function, Technological change, Factor augmentation.

Economists could leave the analysis of production function with the assertion that the causes which determine the amount of technological knowledge at any one time and place are as much outside their province as the tastes which determine consumption patterns. However, we know that significant quantities of resources are being expended by profit-making institutions on research and development. Hence, it is suggested that we must regard the body of technological knowledge as the results as well as the cause of economic changes. A model of the form: Y= F (A (t) K, B (t)L), where Y is output, K is capital, L is labor, and A (t) and B (t) are the total augmentations of capital and labor, respectively, has been suggested. Knowledge, as reflected in A and B appears as an input. It is the suggestion of this paper that such models do not capture the essential features of the creation and transmission of knowledge. Technological progress is in the first instance the reduction in uncertainty. Research and development is thus intimately connected with the problems of uncertainty reduction. Water projects, like others, are housed in uncertainty and as such, a usable model which takes into account uncertainty, would be most helpful to decision makers contemplating investments in water projects. (Loeb-Rutgers)
W69-08063

THE ECONOMIST AND THE 'NEW' CONSERVATION,
British Columbia Univ., Vancouver.
For primary bibliographic entry see Field 03D.
W69-08072

THE FRESH WATER OF NEW YORK STATE: ITS CONSERVATION AND USE.
State Univ. of New York, Buffalo.

Wm C Brown Book Co, Dubuque, Iowa, 1967. 255 p. Lauren B. Hitchcock, Editor.

Descriptors: *Water resources, *New York, *Conservation, River basins, Water pollution, Water management, Limnology, Economics, Government finance, Water quality control, Water pollution control, Energy, Great Lakes, Legal aspects, River basin development, Hudson River, Water quality.
Identifiers: Urban planning, Long Island.

The book is composed of papers by nationally distinguished authorities in the field of water resources and others who participated in a symposium directed primarily at the challenges confronting New York State, but applicable in many cases, to water problems existing nationally and abroad. A summation was presented of where we stand today, which could help resolve some uncertainties, crystallize public opinion, and alert those in government and community life who may still view these water problems with a degree of apathy. The symposium brought together representatives of virtually all fields concerned with our water resources. These included pollution causes and control, water resources management, limnology, hydrology, economics, urban planning, and government. Emerging from this Symposium is the inescapable inference that not much will be accomplished until the federal government finances a much larger portion of the multi-billions required to construct municipal and industrial treatment works, paralleling the country's experience in its expanded program of highways. (See also W69-08077 thru W69-08083). (Loeb-Rutgers)
W69-08076

WHERE NEW YORK STATE STANDS TODAY IN WATER RESOURCES,
State Univ. of New York, Syracuse. Coll. of Forestry.
H. G. Wilm.
The Fresh Water of New York State: Its Conservation and Use, pp 3-9, Wm C Brown Book Co, Dubuque, Iowa, 1967. 7p. Edited by Lauren B. Hitchcock.

Descriptors: *New York, *Water resources, Regions, Floods, Runoff, Erosion, Sediments, Water pollution, Water storage, Water distribution, Planning, Water supply.
Identifiers: Water ownership, Water resources research.

The author discusses New York State's water resource situation, the major problems which it faces, and the steps that are being taken to meet them. The paper first investigates the general water situation in New York State, making necessary comparisons with other regions, and discussing total quantities; floods and accelerated run off, as contrasted with shortages; erosion and sediment; and pollution. Intimately tied in with these variables are the problems of shortage and distribution of water. The author then discusses the ownership of water, including some fallacies in popular conceptions of water ownership in the East. The last part of the paper deals with the various kinds of water resource planning and research that are being conducted in New York State and with activities that are essential for the immediate and more distant future, so that New York State may have ample supplies of clean usable water for the expanding population. (See W69-08076). (Loeb-Rutgers)
W69-08077

PLACE OF WATER RESOURCES PLANNING IN ECONOMIC REGIONAL DEVELOPMENT,
Cornell Univ., Ithaca, N. Y.
David J. Allee.
The Fresh Water of New York State: Its Conservation and Use, pp 170-180, Wm C Brown Book Co, Dubuque, Iowa, 1967. 11 p, 1 fig, 1 disc. Edited by Lauren B. Hitchcock.

Descriptors: *Planning, Investment, Costs, Regions, Industrial water, Productivity, Water resources, Water utilization.
Identifiers: *Economic regional development, Social overhead capital, Growth, Substitutes, Regional growth, Recreational water use, Agricultural water development.

Social overhead capital, which includes much of the investment being planned for water resource development, is a permissive influence on growth, operating largely through the cost structure for directly productive activities. Being only a part of the effort implies that water should be coordinated with other public investment policy. Vigorous planning is crucial in a mature economy because it is probably the expectation of social overhead capacity that is an significant to private investment as existing excess capacity. Regions with relatively small economies are likely to be more concerned with export base effects of water development. Larger regions in addition have an interest in effects on shifts between sectors caused by increased productivity and income. Even when substantial increases in the volume of economic activity do not seem probable it should be possible to increase per capita incomes through increased investment and productivity. The general plea of this paper is to improve our planning analysis and particular our economic analysis, to consider more precisely growth and income distribution goals, at least, in addition to the traditional considerations of efficiency. (See also W69-08076). (Loeb-Rutgers)
W69-08081

WATER RESOURCES MANAGEMENT,
Kansas Univ., Lawrence.
Ross E. McKinney.
The Fresh Water of New York State: Its Conservation and Use, pp 185-189, Wm C Brown Book Co, Dubuque, Iowa, 1967. 5 p. Edited by Lauren B. Hitchcock.

Descriptors: *Planning, *Water manageme
Water supply, Technology, Social aspects, Legis
tion, Water pollution, Domestic water, Industr
water, Recreation, Flood control, Navigati
Water quality, Water treatment.
Identifiers: Power generation.

The author contends that the real need in wa
resources management is for a combin
background in technology and sociology. The so
ing of water problems is as much a sociologi
problem as a technical problem. Our wa
problem has grown because we have failed
respond with imaginative leadership and respor
ble management. The water problem will contin
to grow unless immediate action is taken to so
the problem. Unfortunately, too many people ha
too many self interests to permit a proper approa
to water management. The author contends t
water management problems cannot be solved
legislation or by money alone. These problems c
be solved only by people with ideas and dedicati
(See W69-08076). (Loeb-Rutgers)
W69-08082

THE ROLE OF WATER IN CIVIC PLANNING
New York City Temporary Commission on C
Finances, N. Y.
George H. Deming.
The Fresh Water of New York State: Its Conser
tion and Use, pp 199-203, Wm C Brown Book C
Dubuque, Iowa, 1967. 5 p. Edited by Lauren
Hitchcock.

Descriptors: *Planning, Water management, N
York, Economics.
Identifiers: *Civic planning, Urban developme
Shortages.

New York State will build by the year 2000
urban economy equivalent to that achieved in t
past 175 years. In this development, water manag
ment is but one of the many factors to be acco
modated. Historically, water management h
played a relatively minor role in urban develo
ment. Rather, a laissez-faire approach has been t
predominant pattern. Only lately has the conc
of water as a resource held in public trust had mu
acceptance. Water management as a public fu
tion has been administered through a wide range
organizational forms. It lends itself to an 'aspect
function' approach and divided responsibil
among units and levels of government. The fruits
economic research will play a major role in con
tioning our future patterns and may well dictate
evolutionary pattern of organization. A major h
drance to optimal planning effort is the significa
shortage of skills and manpower. These shortag
must be resolved if progress is to be realized. (S
also W69-08076). (Loeb-Rutgers)
W69-08083

**THE COLUMBIA RIVER TREATY, TH
ECONOMICS OF AN INTERNATIONAL RIVE
BASIN DEVELOPMENT,**
Resources for the Future, Inc., Washington, D. C
John V. Krutilla.
Johns Hopkins Press, Baltimore, Maryland, pp
211, 1967. 211 p, 26 fig, 34 tab.

Descriptors: *Costs, *Benefits, *Administratio
*International Joint Commission, *Columbia Riv
Basin, United States, Columbia River, Flood co
trol, River basin development, Engineerin
Economics, Technology, Political aspects, Negot
tions.
Identifiers: *Columbia River Treaty, Canad
Power production, International agreement, The
mal component, Strategy, National resources.

Formal approval of the Columbia River Treaty
1964 brought to a conclusion two decades of stu
and negotiation by the United States and Cana
for joint development of the Columbia River Bas
The Treaty provides the framework for one of t
most far-reaching water development efforts
North America. The engineering and econom

es made in preparation for international agree-
t on so complex an undertaking as the Colum-
were concerned with the selection of sites, the
g of project construction, and the division of
and benefits between the upstream and
nstream countries. The negotiations were
acted. The issues involved not only the in-
ts of the United States and Canada, but also
e of British Columbia. Also, in the course of
decades changing technological, economic,
political conditions in both countries were fac-
complicating the final decisions. In this book,
illa reviews the process by which the Treaty
e into being and analyzes the economic impli-
ns of the terms. The book, besides being an in-
ndent economic appraisal of a major un-
king in international river development, is a
study of value to future international develop-
efforts and a contribution to understanding
economics of water management. (Loeb-Rut-

-08084

TON AND WELDON ON PUBLIC GOODS,
nia Univ., Charlottesville.
s M. Buchanan.
dian Jour of Econ and Pol Sci, Vol 33, No 1,
11-115, Feb 1967. 5 p.

riptors: Classification, Marginal costs, Con-
tive use, Benefits.
ifiers: *Public good, *Non-private good, *Ex-
l economies, *Allocative norms, *Joint
y, *Utility functions, Public intervention,
o optimality.

author reverses the emphasis of Weldon to say
anything which produces public intervention
e supply of a good insures its public quality. To
onstrate this the theory is applied to a good
is acknowledged to be purely private in the
riptive sense. With the proper definition of
, 'shoes' are treated as a purely public good.
basic distinction that is necessary for this is one
een units in production and units in consump-
With a purely public good, the quantity of
umption units available to each person is mea-
l by the total production. An impure good, en-
he utility functions of several members of the
cal community. Evaluations placed on this
will vary among individuals, not only because
fferences in the utility functions, but also
se of differences in their physically measura-
ervice flows (consumption units). If individual
ation of a particular quantity depends on in-
ual projected utilization, to add an argument
uring this utilization, as Weldon suggests,
s redundant to the author. This argument has
ance for government provision of adequate
r supply as water resources are often con-
ed to have significant public goods aspects.
oloff-Rutgers)
-08085

NOMIC EVALUATION OF PUBLIC IR-
ATION DEVELOPMENT,
omic Research Service, Washington, D. C.
rimary bibliographic entry see Field 03F.
-08086

VALUE OF WATER IN ALTERNATIVE
S WITH SPECIAL APPLICATION TO
ER USE IN THE SAM JUAN AND RIO
NDE BASINS OF NEW MEXICO.
Mexico Univ., Albuquerque.

querque, The University of New Mexico
, 1962. 426 p, 8 fig, 200 tab, 13 append.
aniel Wollman, (Editor).

riptors: *Water values, Recreation, Southwest
Prices, Profit, Cost-benefit analysis, Municipal
r, Industrial water, Employment, Apprecia-
Population, Income, New Mexico, Costs,
el studies, Cost-benefit ratio.

Identifiers: *Alternative uses, San Juan Basin, Rio Grande Basin, Mineral resources, Recreational uses, Primary effects, Secondary effects, Capital requirement, Savings.

The large number of government reports, commissions, symposia, and regional, national, and international conferences devoted to the subject of water indicates an emerging awareness of water as a controlling factor in economic growth. While different specialists have their own views of the 'problem,' its core lies in the growing disparity between the supply and demand for water. Our consumption of water has been growing more rapidly than the increase in population, a state of affairs that has accelerated the pressure on the water supplies of the semiarid parts of the country, notably the Southwest. As a result of the current state of militancy, the new technology of war, and the search for climatic amenities, population has been growing rapidly in those areas in which water shortage historically has been a chronic problem. The present study was prompted by presentiments that the growing shortage of water in certain parts of the country will raise a barrier against sustained economic growth and mobility, and the current experience of the Southwest, where the shortage of water has always been apparent, should help forecast what can be expected over a wider area at a later date. (Loeb-Rutgers)
W69-08087

RESOURCES DEVELOPMENT: FRONTIERS FOR RESEARCH.
Western Resources Conference, Boulder, Colo.

University of Colorado Press, Boulder, pp 1-333, 1960. 333 p, 16 fig, 10 tab, 3 append. Edited by Franklin S. Pollak.

Descriptors: *Resource development, Irrigation, Water utilization, Electricity, Costs, Water supply, Planning, Colorado, Colorado River, Water resources development, Groundwater, Water law, Land use, Mineralogy, Energy, Recreation, Conservation.
Identifiers: *Western Resource Conference, *Atomic energy, Land policy, South Platte River, Arizona v California, River system planning.

The papers presented in this volume were originally presented at the Western Resources Conference held in Boulder in the summer of 1959, under the sponsorship of the University of Colorado, Colorado State University and the Colorado School of Mines. That conference and this book represent a decision by the three sponsoring institutions that the West needs greater knowledge about its resources and that they have a duty to provide it. They plan, therefore, a continuing program on the West's resources, dealing with both conservation and development--a program of instruction and research, supplement by conferences and publications. The topics chosen for the first conference were five major resources--water, land, recreation, resources, minerals and energy and research in relation to resources. The speakers were from a variety of organizations and occupations: universities, the Federal Government, state government and municipal government, Resources for the Future, industry, the private practice of law and engineering. (See also W69-08089 thru W69-08092). (Loeb-Rutgers)
W69-08088

POTENTIAL APPLICATIONS OF NEW WATER TECHNOLOGY IN THE WEST.
Resources for the Future, Inc., Washington, D. C.; and Wisconsin Univ., Madison. Solar Energy Lab.
George O. G. Lof.
Resources Development: Frontiers For Research, pp 39-48, University of Colorado Press, Boulder, 1960. 10 p, 2 tab. Edited by Franklin S. Pollak.

Descriptors: *Technology, Industrial use, Water reuse, Water demand, Water supply, Sea water, Atmosphere, Groundwater, Evaporation.
Identifiers: *Water technology, *Western States, Industrial re-use.

Some new or not yet widely applied methods for increasing the availability of water for men's needs may have particular importance in the Western States. These methods fall into two categories. Applicationof one group of techniques adds to our present supply by reaching new sources or obtaining greater quantities from old sources. The second set of methods permits use of our present supply more effectively. The need for considering ways to augment water availability is real and immediate since our demand for water is increasing rapidly. As such, the subject of increased water supply, through procurement of more water and the better use of existing supplies is of growing concern. The author contends that the United States is not going to run out of water or be faced with a formidable water crisis, for new technology and better and wider application of older technology is going to keep up reasonably well with the requirements. In some localities there will be major difficulties, but none should be insurmountable. The author states that it should be possible to choose a place at random and obtain water at that point, at costs low enough to make it useful for municipal supply. (See also W69-08088). (Loeb-Rutgers)
W69-08089

WATER-RESOURCE DEVELOPMENT, THE ECONOMICS OF PROJECT EVALUATION,
Harvard Univ., Cambridge, Mass.
Otto Eckstein.
Cambridge, Massachusetts, Harvard University Press, 1958. 300 p, 15 fig, 55 tab, 134 ref.

Descriptors: *Water resource development, *Flood control, *Irrigation, *Navigation, *Electric power, *Joint costs, Project purposes, Income, Benefits, Costs, Welfare, Cost-benefit analysis, Political aspects, Social aspects, Risks, Resource allocation.
Identifiers: *Project evaluation, Bureau of Reclamation, Department of the Interior, Army Corps of Engineers, Income distribution, Harbor improvement.

This study analyzes the procedures for measuring benefits and costs employed by two major agencies which are building federal water-resource projects: the Bureau of Reclamation of the Department of the Interior and the Corps of Engineers, U S Army. The analysis is based on the theory of welfare economics. It treats benefit-cost analysis as a means of testing the quality of a project and of selecting the most desirable projects from the point of view of economic efficiency. It is assumed that judgments about changes in the distribution of income and about the political and social objectives must be left to Congress and to administrators, and that the national interest is best served by benefit-cost analyses which reveal each project's impact on the total real national income to be enjoyed by the country. (Loeb-Rutgers)
W69-08093

OUR NATION'S WATER RESOURCES--POLICIES AND POLITICS,
Chicago Univ., Ill.
Ben Moreell.
Chicago, University of Chicago, 1956. 266 p.

Descriptors: *Federal Reclamation Law, *Electric power, *Water resources, *Water policy, Navigation, Reclamation, Flood control, Demand, Conservation, Irrigation programs, Capital, Financing, Colorado River Basin, Capital costs, Columbia River, Cost allocation, Hoover Dam.
Identifiers: *Federal Power Developments, *TVA, Hoover Com, Sacramento River Project.

This is a collection of lectures given by the author at the University of Chicago. The lectures are concerned with water resources and water power as well as the role of the several levels of government-federal, state and local--in a desirable program of

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conservation and development. Their purpose is to further the most economic use of water resources possible. Thus, each project must pass the test of economics in deciding whether it is waste or conservation. The book reviews past and present federal water policies with mention of the accomplishments of the different agencies. The role of the Federal government in the area of navigation, reclamation and flood control as well as the economics of federal power developments are reviewed and discussed. The book concludes with a discussion of the findings of the Hoover Commission Task Force. (Murphy-Rutgers)
W69-08094

THE PERCEPTION OF NATURAL HAZARDS IN RESOURCE MANAGEMENT,
Toronto Univ., (Ontario); and Clark Univ., Worcester, Mass.
Ian Burton, and Robert W. Kates.
Natural Resources Journal, Vol. 3, pp 412-441, January, 1964. 20 p, 5 fig, 5 tab, 54 ref.

Descriptors: *Attitudes, Flooding, Administration, Frequency, Water users, Scientific personnel, Rural areas, Coastal plains, Flood plains.
Identifiers: Natural hazards, Magnitude, Urban areas.

The article is a study of variations in the perception of natural hazards, and of ways in which it affects resource management. Section I defines natural hazards as elements in the physical environment, harmful to man and extraneous to him. Section II classifies natural hazards by their principal causal agent. Section III discusses the magnitude and frequency of hazards. Variations in attitude cannot be explained directly in terms of magnitude and frequency. Section IV considers within-group and between-group variations of two groups: resource users and technical and scientific personnel. Difference in perception are found between agricultural and urban flood-plain users and between coastal and flood plain users. Widespread divergency exists between the perception of flood hazard of technical-scientific personnel and resource users. Resource users often discount the possibility of recurring floods, and reject plans for protection, even when the monetary cost is non-existent. Three reasons for divergence in hazard evaluation are suggested: (1) some users reflect divergencies among scientists; (2) some diverging perceptions are based on different basic attitudes toward nature; and, (3) the mobile user need not be concerned about an area. (Gossen-Chicago)
W69-08099

FRAMEWORKS OF DECISION MAKING,
Chicago Univ., Ill. Dept. of Geography.
Gilbert F. White.
Johns Hopkins University, Water Management Seminars, October 1964 to May 1965. pp 331-344, 14 p, 3 tab, 1 fig, 4 ref.

Descriptors: *Water resources development, *Non-structural alternatives, *Decision making, Water demand, Water supply, Research and development.
Identifiers: *Alternative actions, Perceived needs.

The growing gap between scientific technology and practical application is acknowledged as one of the major problems confronting a solution to water resource problems. The failure of much water management in the United States is attributed to the methods by which decisions are made. This method often leads to two kinds of results: (1) failure of predictions to be realized; and, (2) ignoring opportunities for more fruitful management. The way in which a problem is stated very often determines the results achieved. One of the disadvantages inherent in most economic optimization analyses is the assumption that water managers make rational choices based on decision criteria aimed toward maximization of their profits. This method often excludes interesting alternatives which have not been canvassed but have proven feasible. Perception of needs influence choice as does estimation of the resource and perception of the technology available. The point is made that people who are using the water take a different view of how the water is managed than do the public officials. Suggested by the author is a framework for examining decisions that would be applied first to the resource managers, second to the public agency and third an idealistic framework for the 'objective' student of the situation. Two essential needs are proposed: (1) means by which can be developed greater predictive capacity to anticipate what actions will be taken by resource managers; and, (2) need for research to develop methods of finding a wider range of alternatives and examining their applications. (Starr-Chicago)
W69-08101

SOME ASPECTS OF PUBLIC ORGANIZATION FOR WATER MANAGEMENT,
Syracuse Univ., N. Y. Dept. of Political Science.
For primary bibliographic entry see Field 06E.
W69-08103

COMPREHENSIVE, MULTIPLE PURPOSE WATER RESOURCES DEVELOPMENT,
Corps. of Engineers, Washington, D. C.
Harry A. Schwarz.
Johns Hopkins University, Water Management Seminars, pp 189-196, October 1964 to May 1965. 8 p, 4 ref.

Descriptors: *Water resources development, *River basin development, Project planning, Project purposes, Data collections.
Identifiers: *Alternative goals, Comprehensive planning.

Resource planning for an entire river basin is seen as a problem in environmental engineering. Four distinct steps are identified: (1) identifying the objectives; (2) translating these objectives into specific goals; (3) formulation of a plan; and, (4) evaluation and analysis of the plan to determine the consequences. Since objectives may be conflicting rather than complimentary, a balance must be achieved through the assignment of priorities. The author distinguishes between goals and objectives by asserting that objectives are broad, general statements and goals are measurable, specific items deduced from the broad objective. The formulation of a plan is viewed as the traditional role of engineering planning in which benefits are maximized and costs are minimized. The analysis and evaluation of the consequences of a plan should incorporate in addition to monetary costs and benefits, the social and aesthetic ones, the consequences of alternatives or of inaction, and the effectiveness of the plan in the light of the objectives. The goal of basin planning for the actual planner is described in seven steps: (1) planning for planning; (2) collection of data; (3) determination of needs; (4) determination of capabilities; (5) formulation of a tentative plan; (6) evaluation and refinement of the plan; and, (7) report on the plan. Since the final decision is usually made by some one in the political process other than the planner, the author stresses the importance of writing a plan that is simple enough to be clear to the laymen yet detailed enough for the review by expert. (Starr-Chicago)
W69-08104

THE ECONOMICS OF WATER RESOURCES INVESTMENT,
Pittsburgh Univ., Pa. Center for Regional Studies.
Charles Leven.
John Hopkins University, Water Management Seminars, pp 155-167, October 1964 to May 1965. 13 p, 5 ref.

Descriptors: *Cost-benefit analysis, *Project benefits, *Values, *Economic efficiency, Social aspects, Water resource development, Federal project policy.
Identifiers: *Alternative objectives, Perceived needs.

Discussed is what the author assumes to be the economic problem in water resource develop -- the problem of choice. The author proposes the reason emotions run so high vis-a-vis problems is the fact that there is the feeling there is little chance of success in bringing a the changes they see as important -- incre water recreation; controlling river and stream lution; preserving an adequate supply. There in terms of a generalized society-wide inte some kind of criteria should be developed as a jective crisis for meeting these perceived n These would examine the consequence of alt tive decisions in terms of effects on parti things which people regard as important. Exa The impact not only of building a dam but th pact of the services flowing out of the invest once it has been completed. Water reso development prospects will provide obvious p ry benefits -- making recreational water avail protecting lands from floods, etc. The proble ists in ignoring the secondary benefits -- the e on the economy of the area in which the proj located which makes it attractive for a busine open there. The second problem in ignoring p effects is the implication that the Nat economic welfare is correlated with the Nat gross national product. Examined also is fe resource investment policy which has substa impact on the way in which both population a dustry are located. (Starr-Chicago)
W69-08105

BACKGROUND OF THE WATER RESOUR PROBLEM,
Resources for the Future, Inc., Washington, D.
Irving K. Fox.
Johns Hopkins University, Water Manage Seminars, pp 13-23, October 1964 to May 196 p, 5 ref.

Descriptors: *Social aspects, *Political asp *Economics, Institutional constraints, W resources development, Water supply.

Value considerations are central to problem sociated with water resources. Recognition sh be given to the fact that there are many kin values related to water. Some values are mor ficult to measure than others, such as the val good health resulting from clean water; the val the aesthetics of a beautiful river, and the val making certain decisions about water thr democratic political process. The author prop that the water problem is not a problem of sho of water but the ineffectiveness of policies an stitutions in achieving the more intangible va Discussed are the limitations of tradit economic institutions, the history of effor develop political institutions to complement conventional economic institutions, the t toward federal domination of river basin progr and the trend toward more comprehensive grams. (Starr-Chicago)
W69-08106

CONFLICTS WITHIN RECREATION: EMERGING PROBLEM IN THE ALLOCAT OF WATER AND INVESTMENT FUNDS,
Missouri Univ., Columbia; and Departmen Agriculture, Washington, D. C.
John A. Kuehn, and Durward Brewer.
Land Economics, Vol. 43, No. 4, pp 456 November, 1967. 6 p, 9 ref.

Descriptors: *Recreation, *Decision ma Water allocation (Policy), Investment, Plan Methodology, Recreation demand, Cost-be analysis.
Identifiers: Conflicting recreation demands, planning, Alternatives, Attendance model.

The purposes of this article are to evaluate the of a consistent methodology for choosing a various types of water-oriented recreat developments, and to propose some workable tions. The growing significance of recreation i tional planning is discussed. Outdoor recreatio

ticomponent project; choices must be made veen different facilities to serve various recreaists. A particular problem is the conflict veen stream and reservoir advocates. The insing demand for water recreation, the growing ortance of recreation in water usage, and the rsity among recreational activities have intend the problem of allocating water and investt funds. Norms are proposed for efficient zation of resources. Coordination of the recreal uses of a basin is recommended to satisfy as y of the conflicting demands as possible. The n is the recommended planning unit. The fong methodological standards are endorsed: (1) sideration of all alternative projects and comtions; (2) development of a predictive model estimate attendance; (3) use of benefit-cost ysis to compare future benefits with present future costs; and, (4) separation of the ning and decision-making functions from the struction function. (Gossen-Chicago)
9-08108

BENEFIT-COST ANALYSIS OF LOCAL TER SUPPLY,
isiana State Univ., Baton Rouge. Dept. of nomics.
. Stober, and L. H. Falk.
d Economics, Vol. 43, No 3, pp 328-335, Au-, 1967. 8 p, 1 fig, 1 tab, 6 ref.

criptors: *Cost-benefit analysis, *Local governts, Water supply, Municipal water, Industrial r, Cost comparisons, Return to scale, Interest , Diseconomies of scale, Cost-benefit ratio.

al water resource development requires modifin of the tools which have been developed to yze federal expenditures. The paper focuses on problem of a community faced with a shortage ater for industrial and municipal use. Two alative actions exist: (1) let industrial users lop their own supplies or reduce water conption through either more efficient use or a titution for water; or (2) let the community ly water to industrial and municipal users. The parison is restricted to project financing by the of water. In formula, the cost measurements a community project and a private project are structed. Cost comparisons are drawn. A nuical example of the process is given. The efit-cost ratio will always favor the community ect if there are constant returns to scale and projects are discounted at the same interest This conclusion is a direct consequence of the orate income tax structure. A lower cost of tal to the community then to corporate water s favors the community project. Increasing ms of scale are advantageous to the community ect; diseconomies of scale lower the benefitratio. (Gossen-Chicago)
9-08109

ACT OF COMMUNITY WATER SYSTEMS MALL TOWNS,
ois Univ., Urbana. Water Resources Center.
ter J. Wills, and Donald D. Osburn.
earch Report No 20, Water Resources Center, versity of Illinois at Urbana-Champaign, June 9, iii+ 16 pp. OWRR Project A-027-ILL.

criptors: *Evaluation, Illinois, Project planning r supply, Water users, *Benefits, Indirect efits.

primary purpose of this study was to describe impact the addition of a community water em to a small town would have upon that town the surrounding communities. The benefits of system were recognized by the residents and e of the first round impacts were measured. efits observed were increases in the number of r using appliances, increases in property es, improved fire protection and sanitary conns. Several factors need to be considered when ning future water systems as to the calculation uture needs of the system. Changes which can be expected in population and business activity, changes in the number of water using appliances, and other factors all need to be considered when planning for the successful installation and operation of a community water system. Ample quantities of water are available in Illinois, but intelligent planning for increasing needs, careful management of water supply, and improved waste disposal are essential. Rural people are showing increased concern and are taking action to maintain an abundant supply of clear, safe water for the future. (Betchart-Univ of Ill)
W69-08125

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

DESALTING,
Office of Saline Water, Washington, D. C.
For primary bibliographic entry see Field 03A.
W69-08044

MARKET STRUCTURE AND THE STABILITY OF INVESTMENT,
Michigan Univ., Ann Arbor, Mich.
F. M. Scherer.
American Economic Review, Vol 59, No 2, pp 72-79, May 1969. 8 p, 1 tab, 8 ref.

Descriptors: *Stability, *Capital investment, *Pricing, Industrial production, Demand, Competition, Profit, Equilibrium, Supply.
Identifiers: *Dynamic stability, Industrial organization, Production capacity, Oligopoly.

This paper reports on an empirical study of the link between market structure and dynamic stability. It seeks to determine whether capital investment expenditures were more stable between 1954 and 1963 in concentrated or in atomistically structured industries. With much of water resource planning subject to fluctuations in investment outlay, the model derived here may be used by the water resource planner. The study found investment outlays to be more unstable relative to their trend values in atomistically structured industries. This greater instability was thought to be more the result of low decision-making power dispersion than excessive sensitivity to demand stimuli. (Murphy-Rutgers)
W69-08064

INVESTMENT AND THE FRUSTRATIONS OF ECONOMETRICIANS,
Northwestern Univ., Evanston, Ill.
Robert Eisner.
American Economic Review, Vol 59, No 2, pp 50-64, May 1969. 15 p, 7 tab, 14 ref.

Descriptors: *Resource development, *Technology, *Investment, Planning, Regression analysis, Time series analysis, Costs, Profit, Depreciation.
Identifiers: Econometrics, Theoretical relation, Cross-sectional data, Complications, Simplifications.

The econometrician interested in estimating an investment function is faced with several problems. After determining what relation he wishes to estimate he must question what measured proxies to use for the variables of the theoretical relation. At the root of the difficulty is the fact that investment is forward looking, dependent upon a relation between initial conditions and expectations of the future about which both the investment decision-maker and his econometrician are frequently ill-informed. Estimation is further complicated with the recognition that competition is not perfect. The author considers many other complications which hinder the econometrician in his task. In order to circumvent this situation one would like to simplify; however, it is not at all clear that simplification preserves the essentials of the investment relationship. The author examines some of the difficulties in his own investigation in order to show limitations in this type of analysis. The author concludes that it is a tricky business designing a precise investment relation from ex post variables which fit more or less remotely the usually expectational variables of our true investment relation. It seems highly probable that the relations in the variables we measure are unstable. As such, we might expect similar problems when estimating an investment function for water related projects. (Loeb-Rutgers)
W69-08065

RESEARCH AND DEVELOPMENT, PRODUCTION FUNCTIONS, AND RATES OF RETURN,
University of Southern California, Los Angeles, Calif.
Jora R. Minasian.
American Economic Review, Vol 59, No 2, pp 80-85, May 1969. 6 p, 2 tab, 1 append.

Descriptors: *Technology, Resource development, Return, Regression analysis, Appreciation, Capital, Labor, Benefits, Prices, Profit.
Identifiers: *Production function, *Rates of return, Cobb-Douglas production function, Covariance model, Knowledge, Elasticity, Social return.

This paper reports the results of a study of 'rate of return' to research and development expenditures in a production function setting. Although the tenuous nature of the Cobb-Douglas type of production function was originally indicated by two independent studies in the early 1960's because of its predominance in use, the estimates are obtained by both a covariance model and by the use of a production function of the Cobb-Douglas type. The elasticity of capital and research and development are found to be respectively 0.16 and 0.11. The gross return on investment in research and development is found to be 54 percent as compared with 9 percent for capital. The estimates obtained reflect both successes and failures of research and development projects. To the extent that increased productivity, caused by research and development, is partially passed on to consumers via lower prices for goods, the author's estimate tends to reflect social returns. Water researchers could similarly use production functions in an attempt to estimate rates of return on expenditures for research and development in this area. (Loeb-Rutgers)
W69-08066

EFFECTS OF TAXATION ON RISK-TAKING,
York Univ. (England).
Aiko N. Shibata.
American Economic Review, Vol 59, No 2, pp 553-561, May 1969. 9 p, 2 fig, 9 ref.

Descriptors: *Risks, *Taxes, Investment, Returns, Industrial production, Capital, Labor.
Identifiers: *Risk-taking, Sales tax, Capital allocation, Consumption, Production function.

The author examines the effects of the general sales tax on the distribution of the economy's total capital between risky and sure industries. Few studies exist which analyze the relationships between the changes in the investors' choice and the changes in allocation of real capital among different risk ventures. This paper represents an attempt to construct a new model capable of analyzing the allocation processes of real capital among industrial sectors with different degrees of risk, assuming that the investors evaluate the investment returns in terms of the means and standard deviations. Having constructed such a model, the paper analyzes the effects of the general sales tax on the distribution of real capital among different industries. The study concludes that the general sales tax causes a shift of real capital out of sure industries into risky industries. Water projects are a good example of ventures with different degrees of risk and where a model capable of analyzing the allocation process of real capital among sectors with different degrees of risk would be quite useful. (Loeb-Rutgers)
W69-08068

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GOVERNMENT INVESTMENTS IN MACRO-ECONOMIC PRODUCTION FUNCTIONS (GERMAN),
Walter Wittmann.
Kyklos, Vol 22, Fasc 2, pp 297-313, 1969. 17 p, 1 tab.

Descriptors: Investment, Capital, Capital supply, Time lag, Regression analysis.
Identifiers: *Macro-economics, *Production function, Government investment, Cobb-Douglas production function, Public capital stock, Tertiary capital stock.

The author introduces the government investments into a modified Cobb-Douglas production function. These government investments and the corresponding outlays of the private sector of the economy are divided into a public capital stock and a tertiary capital stock. These stocks are introduced into the production function in addition to labor and the private capital stock. Different time-lags between the income-effect and the capacity-effect are considered. In order to cope with the problems arising from the use of regression analysis, empirical investigations generally use the production function in the linearized form, for which the rates of increases are calculated. At the same time the problem of how to find realistic statistical weights arises for the new explaining variables. The author proposes two methods and calculates one example. A discussion of some empirical problems is presented. Economic data from water projects are often fitted to the form of a production function. The Cobb-Douglas production and the CES production function are the forms often used in this sort of analysis and accordingly this article has relevance to empirical studies of water supply and production phenomena. (Loeb-Rutgers)
W69-08070

MARKET ALLOCATION AND OPTIMUM GROWTH,
Chicago Univ., Ill.
H. Uzawa.
Australian Economic Papers, Vol 7, No 10, pp 17-27, June 1968. 11 p, 3 fig, 9 ref.

Descriptors: *Optimization, *Resource allocation, Planning, Consumption, Investment, Capital, Welfare economics, Mathematical model, Taxes, Equilibrium, Income, Production, Prices, Economics, Resources.
Identifiers: *Economic growth, Market mechanism, Securities, Capital accumulation.

The paper compares the relationships of the growth pattern achieved under the market mechanism versus those of optimum growth with the purpose of bringing about optimal allocation of resources over time. Thus, water resource planning could make use of this theoretical resource allocation discussion. The Solow-Swan growth model is used to show that the level of consumption in a market economy is lower than the optimum level and that the rate of capital accumulation determined in the competitive market is higher than the rate which would have been required to achieve optimum growth when the aggregate capital-labor ratio is larger than the long-run stationary ratio. One of the basic techniques applied is a mathematical reformulation of the Irving Fisher theory of time preference along the lines extended by T. C. Koopmans in a number of recent papers. (Murphy-Rutgers)
W69-08071

PUBLIC GOODS IN THEORY AND PRACTICE: A NOTE ON THE MINASIAN--SAMUELSON DISCUSSION,
Virginia Univ., Charlottesville.
James M. Buchanan.
Jour of Law and Econ Vol 10, pp 193-197, Oct 1967. 5 p.

Descriptors: Marginal costs, Monopoly, Discriminatory pricing.
Identifiers: *Public good, *TV Signal, *Tax-financed, *User charge, Pareto optimality, Marginal evaluation, Tax-price, Joint supply, Consumers' surplus.

Minasian is correct when he states that the modern theory of public goods does not allow us to make institutional decisions about organizational alternatives independently of other considerations. Only the most naive of the theory's advocates should have made this claim although some scholars seem to have interpreted it in this sense. Minasian extends his criticism beyond acceptable limits when he suggests that the allocative norms contained within the theory are incorrect within properly constrained models. His demonstration that other considerations may be dominant in certain real-world circumstances has little relevance to the validity or invalidity of the theory of public goods. It is unfortunate that Minasian failed to separate more fully the theory of public goods from the organizational problems in the TV case. It is equally unfortunate that Samuelson chose to keep the discussion on the same ground. Finally, it is distressing that Samuelson, who could have had the better of the argument, threw his own advantage away by bringing idealogical overtones into what should be a reasoned debate. Water resources are generally acknowledged to contain a public goods aspect and as such this article has relevance to theoretical investigations of the public good nature of water supplies and resources. (Sokoloff-Rutgers)
W69-08075

INVESTMENT DECISION UNDER UNCERTAINTY: CHOICE-THEORETIC APPROACHES,
California Univ., Los Angeles.
Jack Hirshleifer.
Quart Jour Econ, Vol 79, No 4, pp 509-536, Nov 1965. 28 p, 10 fig.

Descriptors: *Investment, interest rate, Probability, Variability, Debt.
Identifiers: *Choice-theoretic system, *Time-preference function, *Risk aversion, *Portfolios, *Marginal utility of income, *Asset-preference approach, equity.

The object of this paper is to develop, and show some of the implications of a treatment of risk or uncertain choice that is a generalization of Fisher's theory of riskless choice over time. It provides an interpretation of Fisher's theory designed (a) to examine its character as a model of choice-theoretic structure, and (b) to introduce the firm as a decision-making unit, which Fisher treated only as atomic individuals. Alternative lines of approach to the theory of risky choice are reviewed, showing how they diverge in specification of the choice-objects of individuals. This is followed by important analytical sections, which develop a theory of uncertain choice over time in terms of comparisons between consumption possibilities in different possible dated contingencies or 'states of the world.' This has some relevance for investment decisions in water resources development projects. (Sokoloff-Rutgers)
W69-08095

THE EFFECTS OF MONETARY POLICY ON EXPENDITURES IN SPECIFIC SECTORS OF THE ECONOMY,
Federal Reserve System, New York.
Sherman J. Maisel.
Journal of Political Economy Vol 76, No 4, Part 11, pp 796-814, July/August 1968, 19 p, 6 tab, 1 fig, 4 ref.

Descriptors: *Gross national product, *Investment, Interest rate, Expenditures, Expansion, Growth rate, Financing, Construction, Mathematical models, Supply, Demand, Industrial production.
Identifiers: *Monetary policy, Credit, Consumption, Housing.

The article tests the different monetary the against available data from 1961 to the pre Monetary policy appears to influence the econ primarily through its impact on spending in par lar sectors. The lags between changes in credit shifts in spending were found to be consider although varying among sectors and effected b pectation. Legal and institutional factors caus distribution of credit among the spending secto alter as supply and demand shift with effec great and greater than the availability and pri credit. The analysis confirmed that higher int rates brought contraction in investment. declines reduced the rate of expansion of inc and hence the rate of expansion of consump Thus, the economy's demand was held within potential rate of expansion of real output. Du its dependence on the supply of investment fu water resource planners are often effected monetary policy and this article should prove ful. (Murphy-Rutgers)
W69-08096

ON MODELS OF COMMERCIAL FISHING,
Massachusetts Univ., Amherst.
Vernon L. Smith.
Jour Pol Econ, Vol 77, No 2, pp 181-March/April 1969. 18 p, 10 fig, 12 ref.

Descriptors: *Commercial fishing, Operating c Marginal costs, Competition.
Identifiers: *External diseconomies, *Reso stock externalities, *Mesh externalities, *Crow externalities, *Quadratic equation, Social cost.

In current fishing theory net return is expressed function either of effort or of number of fisher (K). Most authors assume constant long-run per fisherman, so that cost is proportional to e or (K). Also, fish price is usually assumed t constant, so that total revenue simply follows inverted U-shaped sustainable yield curve. The owner expands exploitation up to the point w net revenue is at a maximum. Under decentrali unregulated exploitation, the equilibrium effo (K) is at the point where all the rent of the fishe absorbed in cost. This theory is able to accoun the situation in which it is not commercially f ble to exploit a fishery; however, it is not ab handle the situation in which a species ma depleted to the point of extinction. This is on the more serious deficiencies in the received trine. In addition, the standard analysis does provide a dynamic theory; it is not explicit a the various types of externalities that may arise does it explicitly distinguish the effect of such ables as vessel catch rate, fish population mass vestment, and mesh sizes. Many of these critic about the need for a dynamic theory, inclusio externalities, and other closely related varia could be applied to some models of water pri (Sokoloff-Rutgers)
W69-08098

A LEGAL-ECONOMIC ANALYSIS OF MINISTRATIVE AND MARKET PROCEDU USED IN THE TRANSFER OF WATER RIGH
Nebraska Univ., Lincoln. Dept. of Agricul Economics.
Loyd K. Fischer, Maurice Baker, and Clayton Yeutter.
Nebraska Water Resources Research Insti Technical Research Project Completion Repo p, 2 ref. OWRR Project A-008-NEB.

Descriptors: *Water rights, *Transfers, *Adm tration, *Economics, *Costs, Water pollution trol, Water supply.

A comparative study of selected states' water and their administration resulted in the recomm dation of the pyramidal institutional structur state water resources board would develop a c prehensive state water plan, gather hydrol data, reserve water rights on behalf of the pu provide leadership in solving state-wide probl and coordinate local administration. This woul

e delineation of geographic boundaries of local
r districts. The local districts--streamflow,
ndwater and combined--would be autonomous
pt for coordination between districts. This
dination would be provided by the water
urces board. Within this administrative
ework, a market for water rights could exist.
rnal or spillover effects could be handled with
type of institutional arrangement. Meat
ing plants in the midlands are generally giving
ary treatment to waste waters. All of the plants
acted, which have been built within the last ten
s are treating wastes before discharge. Reuse of
r is not practiced to a great extent by the
s. Total water costs varied between plants
slightly over one cent to nearly seven cents
hundredweight of processed carcass. In no
was the estimated costs associated with water
ly and waste treatment greater than two per-
of the total operating costs of the plant.
-08115

Water Demand

**LICATION OF AN ELECTRONIC ANALOG
IPUTER TO A STUDY OF WATER
OURCES MANAGEMENT,**
Water Research Lab., Logan; and Utah State
., Logan. Dept. of Civil Engineering.
ne K. Israelsen, and Paul J. Riley.
p on Use of Analog and Digital Computers in
ol, Tucson, Ariz, Dec 1968, Int Ass Sci
ol, Pub No 80, Vol 1, pp 49-58, 1968. 10 p, 8

riptors: *Analog models, *River basin
lopment, *Water management (Applied), *U-
Evapotranspiration, Infiltration, Recharge,
harge (Water), Inter-basin transfers, Surface-
ndwater relationships, Conjunctive use, Water
s.
ifiers: *Weber Basin (Utah), Provo Basin (U-

feasibility of water export from the Weber
, Utah has been contemplated for many years.
problem was to establish in-basin water
irements, probable excess amounts, possible
basin and interbasin water exchanges, and
ssary storage to obtain efficient use of water all
n the framework of current water rights. The
mic flow system of the Weber River Basin was
eled for testing and evaluation on the analog
puter. Once the model was verified, design
s of the basic hydrologic inputs and specific
lopment alternatives were introduced to esti-
the water excess amounts in the upper basin
can be exported, storage capacity required to
tate maximum export with the existing system,
roportions of new and reclaimed water needed
e lower portion of the Basin to satisfy mu-
al and agricultural requirements, and whether
nsfer of water from the lower Bear River Basin
e lower Weber Basin might allow an increase
port to the Provo Basin. The results of this
show some of the possible solutions to the
lem of efficient use of water through interbasin
ntrabasin trade. (Knapp-USGS)
-07745

**ER AND CHOICE IN THE COLORADO
N,**
nal Academy of Sciences, Washington, D. C.
rt White.
Eng, Vol 39, No 6, pp 80-82, June 1969. 3 p,

riptors: *Water management (Applied),
zona, *Colorado River Basin, *Irrigation
r, *Reviews, Decision making, Public rights,
ical aspects, Cost-benefit analysis, Economics,
diction, Water resources development, Op-
ation, Non-structural alternatives.
ifiers: *Central Arizona Project.

n an area is confronted with a water shortage,
lying more water may not always be the best
solution. And in determining what is indeed the best solution, a considerably broader range of alternatives should be considered than has been the practice, for example, in Central Arizona. However, to do an intelligent job of considering more alternatives 2 steps must be taken: (1) Research must be undertaken in a wide range of technical and non-technical matters to provide the basis for establishing alternatives and choosing among them. (2) The choice from among the most promising alternatives should be made not by technical specialists alone, but in close consultation with the public in the area affected (and who will be asked to pay the bills). The specialists should see the public as an ally, not an adversary; for one thing, the public can change the parameters of public acceptability or dollar limitations, and for another, only it can meaningfully weigh the unquantifiable factors such as the value of esthetics and of preserving unique resources. (Knapp-USGS)
W69-07925

FUTURE WATER SUPPLY-FACILITIES, METROPOLITAN WASHINGTON REGION,
Metropolitan Washington Council of Governments, D. C. Board of Engineers.
For primary bibliographic entry see Field 06B.
W69-08024

WATER REQUIREMENTS AND USES IN ARIZONA MINERAL INDUSTRIES,
Bureau of Mines, Denver, Colo. Div. of Mineral Resources.
For primary bibliographic entry see Field 03E.
W69-08058

THE USE OF MODERN SYNTHESIS METHODS FOR THE QUANTITATIVE ESTIMATION OF WATER RESOURCES,
A. Le Saget and P. Prudhomme.
International Conference on Water for Peace, Vol 6, U S Government Printing Office, Washington, D C, pp 436-443, 1968. 8 p

Descriptors: *Underground storage, *Water quality, *Water resources, *Permeability, Piezometers.
Identifiers: *Simulator studies, *Optimum aquifer exploitation, Resource estimation, Rheoelectric tank, Quantitative data, Differential equations, Paris Metropolitan Area.

It was not until water needs increased past the limit of existing reserves that man became aware of the necessity of making optimum use of water resources. This led to the notion of overall resource estimation of the aquifer and basin. However, this notion must not limit itself to static in situ resource estimation; it must also include optimum storage condition determination so that the effects of feed fluctuations can be reduced. Based on this concept, the study of aquifers must go further than the mere determination of their workable reserves; it must define the respective characteristics of the aquifers in view of their optimum exploitation on a regional scale so that fluctuating resources can be adapted to varying needs. To do this, the sole qualitative description of phenomena is not enough; it becomes necessary to call upon precise quantitative methods capable not only of defining in situ reserves, but also of forecasting aquifer evolution as a function of their exploitation and feed variations. This paper attempts to show how these quantitative methods are used to achieve optimum aquifer exploitation and to define and illustrate how they should be used. (Sokoloff-Rutgers)
W69-08073

ARE WESTERN RECREATION RESOURCES ADEQUATE TO MEET NATIONAL AND REGIONAL DEMANDS,
Colorado State Univ., Fort Collins.
Stewart G. Case.
Resources Development: Frontiers for Research, pp 279-286, University of Colorado Press, Boulder, 1960. 8 p, 13 ref.

Descriptors: *Recreation, *Recreation demand, Recreation facilities, Population, Income, Labor mobility, Resources.
Identifiers: *Recreation resources, National demand, Regional demands, City growth, Leisure time.

The author considers factors necessary to be investigated before any decision or conclusion can be made with respect to our future needs of recreation resources. Among the most important of these are population trends, growth of urban areas, increase in leisure time, higher incomes, greater mobility, and an inventory of our resources and facilities. As for population, birth rates are difficult to estimate but it is obvious that there is going to be an increase in the number of potential user of recreation areas. As the population of the United States has increased, the average size of cities has risen from about 8,000 persons in the late eighteenth century to over 20,000 in the middle of the twentieth century. Average density in centers of population has increased by more than fifty percent. There is an increasing amount of leisure time enjoyed by almost everybody as well as an increase in real income. As such, one would expect per capita expenditures on recreation to continue to rise. The new developments in transportation will lead to increased use of recreation areas. Many of the facilities constructed during the 1930's, however, have less capacity now then they did earlier. The author concludes that the Western recreation resources are adequate to meet national and regional demands because of our rapid technological changes. Since water is an important component in outdoor recreation this article has relevance to investigation into water oriented recreation problems. (See also W69-08088). (Loeb-Rutgers)
W69-08092

WATER 'REQUIREMENTS': THE INVESTMENT DECISION IN THE WATER SUPPLY INDUSTRY,
Manchester Univ., (England).
J. J. Warford.
The Manchester School of Econ and Soc Studies, Vol 34, No 1, pp 87-112, Jan 1966. 26 p, 5 fig, 1 append.

Descriptors: *Water requirements, *Water supply, Cost-benefit analysis, Water demand, Prices, Elasticity of demand, Benefits, Marginal costs.
Identifiers: *Investment decisions, *North West England, *Metered consumption, Average cost pricing, Social rate of discount, Capacity, Substitutes, Externality.

Consideration of a scheme such as the Morecambe Bay Barrage, which will yield large quantities of water (estimates vary from 200 to 400 mgd) and involve a highly initial outlay (estimated at pounds 40 million, which does not include the cost of building aqueducts to the consuming areas) requires at least some notion of the value that consumers will place on the water provided. Given present pricing arrangements this information is hardly likely to be forthcoming, but without it, although we are able to choose between alternative investments in water supply, we have no grounds on which to weigh the benefits of investment in water supply against the benefits of any other form of expenditure. As provision of extra supplies becomes more costly, and as water becomes used for less and less necessary purposes, the 'requirements' concept may no longer be sufficient; more sophisticated techniques of assessing the relative costs and benefits of water supply projects are now appropriate to match scientific and engineering advances in the industry. The view that 'water is cheap at any price' is almost certain to lead to over-investment in water supply projects. (Sokoloff-Rutgers)
W69-08097

6E. Water Law and Institutions

LEASEHOLD INTERESTS IN EMINENT DOMAIN,
Oklahoma State Dept. of Highways, Oklahoma City.

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Floyd Taylor, and John Paul Walters.
Highw Res Rec, No 258, pp 8-21, 1968. 14 p, 90 ref.

Descriptors: *Leases, Rent, *Eminent domain, *Condemnation, Pricing, Right-of-way, Legal aspects, Real property, Property values, Land tenure, Value, *Land appraisal, Evaluation, Legislation, Bibliographies, Appraisals, Land ownership.
Identifiers: Land acquisition.

Condemning leasehold estates involves problems not present in condemning properties where ownership is unencumbered. Several states have reached different solutions in dispensing so-called just compensation. In some situations, immediate equities take precedence over logic and reason in arriving at just compensation. hopefully, in most applications, reason and logic, and immediate equities coincide with a finding of just compensation. Just compensation involves balancing reason and equity in determining the relative rights of the landowner and public. The right to jury trial in eminent domain cases is the most effective method of ensuring the precedence of immediate equities over cold logic and reason in finalizing the rights of the parties. Of course, the jury cannot stray far outside the bounds of logic and reason in applying a layman's sense of justice to a particular rule of compensability. Juries can rectify inequitable results of strict applications of rules of noncompensability not meeting expectations of the lay-legal conscience. Yet, the question remains as to whether this is fair to the condemning public. Hopefully, a jury's verdict will lie somewhere in the gray area between the layman's conscience and the legally defined rights of the public. (USBR)
W69-07814

INSTITUTIONAL CONSTRAINTS ON THE DEVELOPMENT OF A REGIONAL WATER SUPPLY SYSTEM: THE CASE OF DETROIT,
For primary bibliographic entry see Field 06B.
W69-07871

WATER RESOURCE DEVELOPMENT IN CALIFORNIA: THE COMPARATIVE EFFICIENCY OF LOCAL, STATE, AND FEDERAL AGENCIES,
Resources for the Future, Inc., Washington, D. C.
For primary bibliographic entry see Field 06B.
W69-07873

STATE REFORESTATION PROJECTS.

Minn Stat Ann secs 84A.31 to 84A.42 (1947).

Descriptors: *Minnesota, *Forests, *Reforestation, *Conservation, Forest fires, Lakes, Streams, Wildlife, Fishing, Wildlife conservation, Management, Regulation, Local governments, State governments, Taxes, Eminent domain, Land, Ditches, Drains, Financing, Projects, Administrative agencies, Legislation, Legal aspects, Supervisory control (Powers).
Identifiers: Afforestation.

For the purpose of vesting the state with title to land suitable for the development of forests and fire prevention, for advancing afforestation and reforestation, for controlling and regulating lakes and streams, and for creating game and fish reserves, the county commissioners of any county in which such lands are situated, and upon which certain taxes are delinquent, may propose that the state take over the land as a forest project. Each such project shall be under the control of the Department of Conservation which shall make rules and regulations for the care of the forests, streams and lakes, wildlife and land. The county auditor shall certify any such land to the state auditor who shall pay the delinquent tax to the county, and the land shall be transferred to and held by the state in fee. The state shall have the right of eminent domain over any provate land within any project. (Helwig-Fla)
W69-07878

COMPLIANCE WITH ARTICLE SUSPENDED WHERE REQUIRED EQUIPMENT UNOBTAINABLE; ALLOWANCE FOR PLANNING AND INSTITUTING CHANGES.

W Va Code Ann sec 22-2-76 (1966).

Descriptors: *West Virginia, *Legislation, *Coal mines, Drilling equipment, Earth handling equipment, Electrical equipment.
Identifiers: Rock-dusting machines, Flame safety lamps.

Whenever any equipment or supplies required by this article, including rock-dusting machines, flame safety lamps, and permissible electric equipment, are unobtainable in the normal course of business, compliance with the requirements of this article with respect thereto is suspended so long as such items remain unobtainable. Due allowance shall also be made for planning, institution of change procedures, and installation of new equipment. (Carruthers-Fla)
W69-07879

WILLIAMS V STATE (FLOOD DAMAGE FROM OVERFLOWING STORM SEWERS).

74 NYS 2d 647-653 (N Y Ct Cl 1947).

Descriptors: *New York, *Storm drains, *Surface runoff, *Flooding, Surface waters, Stormflow, Flood damage, Overflow, Sewers, Drainage water, State governments, Concrete pipes, Storms, Cities, Channel flow, Diversion, Alteration of flow, Manholes, Natural flow, Regulated flow, Rainfall, Judicial decisions, Legal aspects, Rainfall intensity.
Identifiers: *Act of God, Catch basins.

Plaintiff brought action against the state to recover for flood damages to his building caused by the overflowing of state-owned storm sewers alleged to have been negligently constructed and maintained. Defendant asserted that on the dates in question, there was a rainfall of unprecedented severity that could not reasonably have been anticipated and that it was such as to be deemed in law an act of God. The court held that the rainfalls were not of unprecedented severity and could not be urged by defendant as an act of God to defeat plaintiff's claim. Furthermore, from the evidence, the court was of the opinion that the storm sewers were not properly constructed and maintained and that this constituted negligence which proximately caused the overflowing of plaintiff's property. A city is not liable for an increase in flow of surface waters resulting solely from the pavement of streets, but where it collects surface water into a single channel and casts it into a stream, filling it beyond its natural capacity, and flooding an adjacent owner's land, the city is liable. The court concluded that plaintiff was entitled to recover damages. (Reed-Fla)
W69-07880

IMPROVEMENT, STORAGE AND SEWAGE DISPOSAL DISTRICTS IN NEW YORK.

N Y Town Law secs 190, 190a, 190b, 190c, 190d (McKinney 1965), as amended, (McKinney Supp 1968).

Descriptors: *New York, *Legislation, *Regulation, *Local governments, Cities, Administrative agencies, Water districts, Public utility districts, Hydraulic structures, Docks, Navigable waters, Water supply, Reservoirs, Sanitary engineering, Sewage disposal, Sewers, Sewage treatment, Legal aspects.
Identifiers: Statute.

The town board, upon proper petition, may establish or extend improvement districts including water supply and sewage treatment districts. A town may establish a public dock district or beach erosion control district pertaining to any navigable waters within the town's jurisdiction. However, a water supply district may not be established or extended so as to include lands situated in another water district. Water storage districts and wat tribution districts may also be established b town board. A sewage disposal district shall c of sewer districts which need not be contig Establishment of the forgoing districts is preceded by public hearing, notice of which is published by the board. At any time within days after the board has acted on a requ establish such a district, a petition request referendum may be filed. All petitions unde statute will be sufficient if signed by twent real property owners within the affected di (Katz-Fla)
W69-07881

GENERAL PROVISIONS AND FISHING R LATIONS.

Del Code Ann tit 7, secs 901-917 (195 amended, (Supp 1966).

Descriptors: *Delaware, *New Jersey, *Del River, *Fish management, Interstate com Regulation, Legislation, Fish conservation, Fi Sport fishing, Commercial fishing, Shell fish, fish, Nets, Fyke nets, Gillnets, Fishing gear harvest, Bait fishing, Recreation.
Identifiers: *Delaware Bay, Penalties.

The provisions herein, affecting only the wat the Delaware River and Bay lying be Delaware and New Jersey, extend uniform fi regulations to inhabitants of both states. Gam may be taken only with rods or hand lines, having no more than 3 hooks, or artificial bai no more than 3 hooks. Any type fish, except fish, may be taken between the high and low mark with any net, hook and line or othe pliance. Bait fish may be taken with rods, lines, minnow seines less than 100 feet long, nets. Food fish may be taken with seines, gill eel pots, parallel nets, or rods and hand lines use of stake nets is prohibited except when reason of oyster stakes, use of drift nets is por Taking of fish by explosives or poison is prohi The use of nets is prohibited from 2 p.m. Sat until 12 o'clock midnight on Sunday. The u food fish for extracting oil or making fertilize the use of rakes and dredges from July 1st th September 1st south of Mahon's River and w Blakes's channel, is prohibited. Non resident aliens may take fish only by use of rods or lines. Violations of these provisions are punis by fine and/or imprisonment. The terms ' fish,' 'bait fish', and 'food fish' are defined. (K Fla)
W69-07882

DAMS AND LAKE WATER LEVELS.

Minn Stat Ann secs 110.121 to 110.22, 110. 110.40, 110.46 to 110.53 (1967).

Descriptors: *Minnesota, *Dams, *Floo *Bodies of water, Local governments, Cons tion, Surveys, Water conservation, Repa Maintenance, Legislation, Dam construc Damsites, Dikes, Flood control, Water su Water levels, Lakes, Reservoirs, Cities, Easem High water mark, Low water mark.
Identifiers: Logging dams, Logging str Flowage easements.

The county boards of commissioners are powered to control and maintain certain bodies. The boards have authority in mapping praising, condemning and developing imp ments. For the protection of the natural featu certain waterbodies, limitations on constru and flooding are defined. The policies, limitat liabilities and rights pertaining to the erecti dams on rivers and streams are provided. Resp bilities for damages from overflow caused by are defined and liability established. Regula pertaining to maintaining water levels in c bodies of water, the rights of property owne fected by flowage easements and regulations

ng abandonment of dams are given. The
ral policy covering dams and reservoirs and
ral operational plans are stated. (Helwig-Fla)
-07883

IS AND LAKE WATER LEVELS.

Stat Ann secs 110.121 to 110.22 (1967).

riptors: *Minnesota, *Dams, *Flooding,
n construction, Bodies of water, Local govern-
s, Conservation, Surveys, Water conservation,
lation, Damsites, Flood control, Water levels,
s, Reservoirs, Cities, Easements, Lumbering,
gable streams.
ifiers: Logging streams.

oard of county commissioners of any county
improve any waterbody located in the county
hance navigation or to promote the public
re. The public shall have access to any water-
so improved. If a new dam is constructed in
ection with the improvement, the board shall
the power to remove any old dam rendered
ss. To preserve natural features, no dam shall
uilt across certain designated waterbodies
ut special legislation. A dam may be erected
s a nonnavigable stream causing the land of
s to be overflowed if the land is acquired by
am owners through the proper legal proceed-
The county board may license anyone desiring
ect a dam for the purpose of sluicing and driv-
gs and timber. The owner of land bordering
nonnavigable stream available for floating logs
dam the stream to develop power or to furnish
cipal water supplies. However, such dam must
pplied with sluiceways or locks for floating
round it. (Helwig-Fla)
-07884

E WATER LEVELS.

Stat Ann secs 110.31 to 110.40 (1967).

riptors: *Minnesota, *Dams, *Littoral, *Ease-
s, Navigation, Recreation, Water levels, Con-
tion, High water mark, Dam construction,
ent domain, Riparian owner, Damsites,
lation, Flood control, Water supply, Lakes,
inistrative agencies, Riparian land, Overflow.
ifiers: Littoral owner, Perpetual flowage ease-
s.

ny lake where: (1) a dam affecting water level
have existed at the outlet of the lake for at
15 years; (2) the lake shall have been used for
ation, fishing, hunting or other purposes; (3)
uses of the dam shall have been abandoned;
4) the continuance of lake level regulation is
able, it shall be presumed that any littoral
r has dedicated a perpetual flowage easement
ll overflow resulting from the operation of
dams. The Commissioner of Conservation
accept a conveyance or release from any
r granting the state a flowage easement on his
The effect of any easement so obtained by the
may be determined by an action brought in
ame of the state in the district court. Every
ment obtained on account of any dam shall at-
and be appurtenant to such dam and the pur-
s thereof. Any high water mark established by
dam authorized herein shall supersede the
ral high water mark of the waters affected. Any
not in use for 15 years shall be presumed aban-
d. (Helwig-Fla)
-07885

TER CONTROL WORKS AND WATER ELS.

n Stat Ann secs 110.46 to 110.53 (1967).

riptors: *Minnesota, *Dams, *Water control,
adwaters, Flooding, Flood control, Navigable
rs, Conservation, Legislation, Silt, Lakes, Lake
, Administrative agencies, Projects, Federal government, Water rights, Regulations, Reservoirs, Wildlife, Wild rice, Discharge (Water), Reservoir silting, Mississippi River, Sediment control.
Identifiers: Water control works, Reservoir elevation.

The existing dam and appurtenant water control works on Big Stone Lake, a public navigable waterbody, are inadequate and ineffective to conserve, control, and maintain the waters for public purpose. The works aggravate the deposit of silt on the lake bed. A project plan to remodel and complete said works has been prepared by the Commissioner of Conservation and approved by the South Dakota-Minnesota Boundary Waters Commission. The Commissioner is authorized to construct, maintain and operate said project. The Commissioner is authorized and directed to enter into a cooperative agreement with the United States to control and regulate the reservoirs in the headwaters of the Mississippi River. The purpose of the agreements shall be to regulate the elevation and the discharge of the reservoirs. The plan shall include operation of the reservoir dams so that desirable lake levels are maintained for recreation, with due consideration given to the growing of wild rice, protection of wildlife resources and maintenance of headwater, river uses and water level minimums. The plan shall anticipate abnormal inflow emergencies, navigation requirements and flood control. (Helwig-Fla)
W69-07886

TIDAL WATERS.

Md Ann Code Art 66C secs 262, to 268 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Commercial fishing, *Tidal waters, *Nets, Administrative agencies, Legal aspects, Legislation, Water policy, Water law, Fishing, Fishing gear, Commercial fish, Fisheries, Striped bass, Gars, Carp, Sharks, Fish management, Regulation, Reasonable use, Water policy, Equipment, Navigation, Electro-fishing, Permits, Spawning.
Identifiers: Obstruction to navigation.

Only residents and landowners may fish with nets in the tidal waters of the state. It is unlawful to take fish by the use of a gig, purse net, buck net, beam trawl, otter trawl, trammel net, troll net, or drag net except in waters of the Atlantic Ocean. With an appropriate license commercial fishermen may use up to five dip nets, hoop nets, and pound nets for taking finfish. Use of airplanes and electronic devices in tidal waters for locating fish is illegal. As regulated by the Department of Chesapeake Bay Affairs, fishing in certain striped bass spawning areas is illegal. There are a number of regulations governing commercial sale of striped bass. Pound or stake nets are limited in size and may not be used where they will impede or obstruct navigation. It is unlawful to use two or more power vessels to drag a seine and to use a seine in excess of 600 yards in length. There are a number of other restrictions relating to size and use of seines. Bow and arrow is a legal means of taking carp, garfish, bullfish and shark. (Johnson-Fla)
W69-07887

NATURAL RESOURCES INSTITUTE.

Md Ann Code Art 66c secs 18 through 21 (1957).

Descriptors: *Maryland, *Water resources development, *Natural resources, *Schools (Education), Conservation, Legal aspects, Legislation, Water law, Water policy, Social aspects, Administration, Education, Facilities, Fish management, Wildlife management, Surface waters, Governments, Institutions, Planning, Tidal waters, Universities.

The Natural Resources Institute is a part of the University of Maryland and supersedes the Department and Commission of Research and Education. It conducts a comprehensive research and educational program covering the nonagricultural and forestry natural resources of the state. There is emphasis on tidewater and inland resources and organisms, including fish and wildlife, and surface water of the state. It cooperates with all related agencies whether governmental or private. Its staff may collect such animals, plants and other samples and use those collecting devices, seasons, and techniques as are necessary to fulfill its purpose. The Board of Regents of the University of Maryland supervises and controls the institute. The institute's director serves as a member of the Board of Natural Resources and the Water Pollution Control Commission. (Johnson-Fla)
W69-07888

ROADS AND HIGHWAYS.

W Va Code Ann secs 17-17-2, 17-17-4, 17-17-5, 17-17-17, 17-17-25, 17-17-30, 17-17-31 (1966).

Descriptors: *West Virginia, *Bridges, *Bridge construction, *Ohio River, Legislation, Permits, Federal government, State governments, Local governments, Boundaries (Property), Navigable rivers, Nonnavigable waters, Streams, Locks, Contracts, Leases, Navigation, Construction costs, Cost repayment, Loans, Administrative agencies, Administrative regulation.
Identifiers: *Bridge corporations, *Toll bridges, Great Kanawha River, Big Sandy River, Obstructions to navigation, Nuisance (Public), Tolls.

Corporations may be formed to construct bridges across the Ohio, Great Kanawha, and Big Sandy Rivers in the manner provided by the U S Congress. Bridges constructed contrary to the provisions of this statute are deemed nuisances. No bridge shall be constructed so as to obstruct navigation. The state road commissioner may purchase land and construct toll bridges over any river lying wholly or partly within the state or forming a boundary of the state with the proceeds of bridge revenue bonds. No bridge shall be constructed across any river between any bridge and any bridge owned by the state and operated as a toll bridge by the state road commissioner, except under a permit of the commissioner, until a certificate of convenience and necessity is granted by the public service commission. Incorporated cities are authorized to construct toll bridges or tunnels over or under rivers from a point within the city to the opposite shore. Such cities may purchase existing bridges owned by bridge companies or corporations. (Kahle-Fla)
W69-07889

ROADS AND HIGHWAYS.

W Va Code Ann secs 17-17-2, 17-17-4, 17-17-5 (1966).

Descriptors: *West Virginia, *Bridges, *Bridge construction, *Ohio River, Federal government, State governments, Local governments, Locks, Tributaries, Channels, Standards, Navigable rivers, Contracts, Leases, Legislation, Navigation, Bridge design, Engineering structures.
Identifiers: *Nuisance (Public), *Obstruction to navigation, Bridge corporations.

Corporations may be formed and railroad corporations are authorized, to construct toll bridges across the Ohio River in a manner provided by the U S Congress. Real estate may be obtained according to law and purchases made from other bridge corporations. Subscriptions to stocks and bonds may be made by counties, districts, municipalities and other corporations. Corporations may be formed to construct bridges across the Great Kanawha or Big Sandy Rivers in like manner--provided that bridges across the Great Kanawha between the U S government lock number six and lock number three or between lock number three and a point 600 feet below the intersection of the Kanawha and Nancy's branch shall have at least one channel span, the center of which shall be the middle of the channel run by coal fleets. Such span

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shall have a clear opening of 400 feet at low water line and be at least 65 feet above low water. Bridges constructed contrary to the provisions of these sections are deemed public nuisances abatable by indictment of bill in equity brought by the attorney general or prosecuting attorney of the proper county. Bridges shall be constructed as not to obstruct navigation of the watercourse at any ordinary stage of water. (Kahle-Fla)
W69-07890

ROADS AND HIGHWAYS.

W Va Code Ann secs 17-17-17, 17-17-25 (1966).

Descriptors: *West Virginia, *Bridges, *Bridge construction, *Permits, Boundaries (Property), Bridge design, Public benefits, Right-of-way, Easements, Legislation, State governments, Navigable rivers, Nonnavigable waters.

The state road commissioner may construct bridges of such design and at such places approved by the state road commission over any river lying wholly or partly within the state or forming a boundary of the state. Such bridges are to be financed with the proceeds of bridge revenue bonds. The commissioner may purchase land, structures, rights-of-way, franchises, easements, and other interests in land deemed necessary for the construction of such bridges. Sections 17-17-13 to 17-17-28 are deemed alternative methods for the doing of things authorized hereby in addition to powers conferred by other laws--provided that no bridge shall be constructed between any bridge and a bridge owned and operated by the state as a toll bridge, except under written permit of the commissioner, until a certificate of convenience and necessity is granted by the public service commission. Application for such a certificate shall contain a map showing the location and design of the bridge to be built, the location of existing bridges between which the bridge is to be built, the location of public roads leading to the existing bridges and any other information deemed necessary. The public service commission before issuing a certificate must by investigation and hearing determine that there is imperative public need for such a bridge and that the revenue from any state owned bridge will not be materially impaired by construction and operation of the bridge. This proviso shall not apply where tolls from the state-owned bridge are used only for maintenance, repair and operation of the bridge. (Kahle-Fla)
W69-07891

ROADS AND HIGHWAYS.
W Va Code Ann secs 17-17-30, 17-17-31 (1966).

Descriptors: *West Virginia, *Bridge construction, *Local governments, Bridges, Construction costs, Cost repayment, Loans, Federal government, State governments, Navigable rivers, Nonnavigable waters, Streams, Regulation, Leases, Contracts.
Identifiers: *Toll bridges, Tolls.

Any incorporated city or county court of any county in which there is a portion of a navigable or nonnavigable river may construct and maintain a toll bridge or tunnel across such river from a point within the city to the opposite side of the river. No bridge may be built contrary to federal regulations or without approval of the state road commission. Bridges may be funded by bonds or from state or federal loans. Any such city or county so situated may purchase, or lease, existing bridges from any bridge company or corporation with funds from the same sources. (Kahle-Fla)
W69-07892

TOWN OF PADEN CITY V FELTON (DRAINAGE DITCH AS EASEMENT).

66 SE 2d 280-297 (W Va 1951).

Descriptors: *West Virginia, *Drainage systems, *Easements, *Surface drainage, Ditches, Judicial decisions, Legal aspects, Cities, Surface waters, Surface runoff, Drainage water, Public rights, Obstruction to flow, Prescriptive rights, Prior appropriation, Competing uses, Relative rights.
Identifiers: Injunction (Prohibitory).

Defendant owned two lots traversed by a drainage ditch carrying surface water runoff from adjacent land and streets. The ditch was cleaned intermittently by the town of Paden City. Defendant obstructed the flow of water in the ditch by accumulating debris therein which allegedly caused flooding, stagnant water, sewer overflow and damage to adjacent sidewalks. Plaintiff town sought to enjoin the interference with the water flow and to abate the alleged nuisance resulting from this obstruction to flow. Plaintiff based its claim alternately on the theories of implied dedication and easement by prescription. The court disagreed on both theories, holding that plaintiff's activities regarding prescriptive rights and rights by dedication were too isolated, sporadic and equivocal to substantiate its claim for relief. The mere use by the public of a private drainage ditch was held not to show a dedication. (Carruthers-Fla)
W69-07893

TOWN OF MEREDITH V STATE BOARD OF HEALTH (STATUTORY POWERS OF THE BOARD OF HEALTH TO ENFORCE REGULATIONS).

48 A 2d 489-496 (N H 1946).

Descriptors: *New Hampshire, *Administrative agencies, *Legislation, *Pollution abatement, Sewage disposal, Pollution identification, Judicial decisions, Water law, Water sources, Public health, Lakes, Ice, Sewage, Administrative decisions, Remedies.
Identifiers: *Injunctions (Prohibitory).

Plaintiff, town of Meridith, bordered on a lake used as a public water supply. Quantities of the town's sewerage flowed into the lake. Defendant, the State Board of Health, pursuant to its statutory authority issued orders and regulations directing plaintiff to install a public system of sewerage. Plaintiff sought to restrain defendant from enforcing these orders. The lower court certified the following questions of law, determinative of the case, to the State Supreme Court: (1) whether the orders and regulations issued by the defendant were within the powers conferred by the statutes; (2) whether the statutes conferring such powers were unconstitutional as a delegation of legislative power; and (3) whether in the exercise of such powers the defendant must comply with the notice requirements of the State's Constitution. Question one was answered affirmatively and two and three negatively. The court held that the statutes adequately provided the defendant with the power to make and compel compliance with the regulations. Furthermore, the broad grants of authority given to the board required expert investigations and findings not normally possible for the legislature to make and hence such powers to make regulations and issue orders is constitutionally delegable. Since Boards of Health act summarily, notice need not be given. (Holt-Fla)
W69-07894

GRAMMAS V COLASURDO (UPPER OWNER MAY ENTER LOWER ESTATE TO CLEAR COMMON DRAINAGE DITCH).

48 N J Super 543, 138 A 2d 553-559 (1958).

Descriptors: *New Jersey, *Prescriptive rights, *Easements, *Natural flow doctrine, Judicial decisions, Water rights, Right-of-way, Drainage, Drainage practices, Ditches, Reasonable use, Obstruction to flow, Relative rights, Natural use, Legal aspects.
Identifiers: Easements by prescription.

Plaintiff sued defendants in trespass, alleging defendants entered upon his land to widen deepen a drainage ditch. The defendants, cra ry bog owners, were preparing the ditch to re the excess waterflow incident to the sea drainage of their upland bogs. The defen claimed alternatively that they had an easeme the plaintiff's portion of the ditch, that they legal right to compel the plaintiff to remove an structions from the ditch, and that the defen had a right to enter upon the plaintiff's land to the ditch if he refused to clear it. The trial refused to offer the above instructions and th found for the plaintiff. This court reversed an manded. All of the defendants' proposed ins tions were founded upon the defendants' lon of the ditch to drain their bogs, thus making o argument for an easement by prescription. Th fendants claimed easement would extend t doing of anything that was reasonably necessa prepare the ditch for the increased flow. In circumstances, the upper owner may enter th vient estate to remove obstructions to his rig way as long as there is no breach of peace. (H Fla)
W69-07895

NELSON V WILSON (SATURATION BY R ING WATERTABLE CAN CONSTITUTE T ING OF THE LAND).

58 N W 2d 330-335 (Minn 1953).

Descriptors: *Minnesota, *Dams, *Under *Flood damage, Water injury, Backwater, Ju decisions, Saturation, Condemnation, W management (Applied), Water control, Per tion, Soil moisture, Soil texture, Underseep Legal aspects, Flooding, Floodwater, Soa Eminent domain, Agricultural watersheds.
Identifiers: Action in mandamus.

Plaintiff brought an action in mandamus to co the commissioner of conservation to condemn compensate him for lands taken by floodin legedly caused by the state's water control pro The plaintiff's land was located below the pr dam and had been used for agricultural purp The land was rendered unsuitable by the floo caused by maintaining standing water in a poo certain level, at regular intervals after the pr was built. The plaintiff also owned land abov dam which allegedly was ruined when the wate poundment saturated the soil and raised the w table. This court affirmed and modified an o compelling the state to condemn the land. overflowing of land by backing water onto it dams constitutes a taking of that land. A ta may also occur through underflowing or per tion which raises the water table to the extent the land is rendered wet enough to impai agricultural value. Any substantial interfer with private property which detroys or lesse value, or by which the owner's use or enjoyme substantially abridged is in fact and law a taki the extent of the damages suffered even thoug title and possession of the owner rem undisturbed. (Blunt-Fla)
W69-07896

DAMS IN DISREPAIR; ACQUISITION BY NICIPALITY.

N H Rev Stat Ann secs 482:42 thru 482:59 (19

Descriptors: *New Hampshire, *Dams, *Repai *Eminent domain, Legislation, Maintena Operation and maintenance, Investigations, Or investigations, Cities, Local governments, C pensation, Administrative agencies, Adjudica procedure, Legal aspects, Dam construction, M tenance costs.
Identifiers: *Dams in disrepair, Water resou board.

The owner of a dam has a duty to maintain repair such structure. A town or city may pet the water resources board to hold a public hea

termine whether a particular dam is in air. The board must give proper notice and nspect the dam. The board may also initiate a ng upon its own motion. If the board finds the n disrepair, it requires the owner to make the site repairs. Should the owner fail to comply, own in which a portion of the dam is located petition the board for eminent domain edings. After proper notice, the board must a public hearing, provided the town's voters authorized the proceedings. The board shall what property and rights are reasonably red for the town to construct, maintain, , own, and operate the dam so that it will not ne a dam in disrepair. If the board shall find payment to the owner does not exceed the rized town debt, it shall determine the com- tion to be paid and render judgment ac- ngly. Any aggrieved party may appeal the of the board. (Breeze-Fla)
07897

E RURAL ELECTRIFICATION AUTHORI- CT (POWER OF AUTHORITY TO MAKE 'EYS).

ode Ann, sec 24-308 (5) (1962).

iptors: *South Carolina, *Administrative ies, *Surveys, Legislation, Economic feasi- Sounding, Electric power costs, Legal ts, Project planning, Evaluation.
fiers: Rural electric authority, Acquisition.

ct only to the Constitution of the State, the rity shall have power to cause surveys to be of areas throughout the state for the purpose termining the economic soundness of the sition of a system therein, to make plans and ates of the cost of such system and in connec- herewith to enter on any lands, waters, and ses for the purpose of making such surveys, ings and examinations. (Gadd-Fla)
07898

BART V PASSAIC VALLEY WATER M'N (CONDEMNATION OF WATER TS).

2d 24-27 (N J Ct Err and App 1947).

iptors: *New Jersey, *Eminent domain, rian rights, *Condemnation, Compensation, ges, Rivers, Streams, Riparian land, Legisla- Legal aspects, Water law, Local governments, al decisions, Diversion, State governments, nents, Prescriptive rights, Administrative ies.
fiers: Adverse use.

llant water commission petitioned for a deter- ion of its right to divert 150,000,000 gallons ter per day from locations upstream from ndent's land. Appellant later requested and ranted leave to amend the petition to a diver- of 52,400,000 gallons because it asserted a riptive right to divert 22,600,000 gallons gh adverse use and a right to 75,000,000 gal- through a contract right obtained from its cessor in title. Respondent objected to the dment asserting that appellant had failed to ly with condemnation statutes requiring ap- t to obtain the consent of the State Water Commission before condemning the proper- ht. The court held that the statute would not to appellant if it could prove its contractual to divert water. The court found that appel- ad failed to so prove. The case was remanded. vig-Fla)
07899

NE: BUREAU OF WATERCRAFT REGIS- TION AND SAFETY (COMPREHENSIVE TUTE REGULATING USE OF POWERED MOTORCRAFT).

38 Me Rev Stat Ann secs 231-241 (1965), 38 Me Rev Stat Ann secs 233, 234, 238, 242, 243, 244, (supp 1968-69).

Descriptors: *Maine, *Boats, *Boating regulations, Administrative agencies, Legislation, Standards, Safety, Recreation permits, Outdoor recreation, Administrative regulation, Water sports, Marinas.
Identifiers: *Power boats.

The State Bureau of Watercraft Registration and Safety is created. The Bureau's purpose is the registration of watercraft and the promotion of safety for persons and property. The bureau is empowered to adopt or amend regulations governing the use and operation of watercraft and safety equipment, including the type, quality and quantity of such equipment. All boats propelled by engines of more than 10 horsepower and all motor boats for hire must have a state certificate and display a registration number. This includes all types of watercraft whether or not engines are their principal source of power. Further provisions detail the methods for displaying identification numbers and provide that failure to produce a certificate on request is prima facie evidence of non-compliance with this article. Certain enumerated classes of motorboats are exempt from the numbering provisions. Certificated owners must notify the state upon the destruction, abandonment, removal, or transfer of ownership of their watercraft. Additional regulations cover boats available for hire. Other sections govern boat operation, regattas, and procedures governing boating accidents. (Blunt-Fla)
W69-07900

MOTOR BOATS, REGISTRATION, EQUIPMENT AND OPERATION.

Del Code Ann tit 23, secs 2111-2130 (Supp 1966).

Descriptors: *Delaware, *Boats, *Boating regulation, *Administrative agencies, Local governments, Legal aspects, Legislation, Boating, Water law, Water policy, State jurisdiction, Permits, Safety, Regulation, Jurisdiction, Marinas.
Identifiers: Negligence, Strict liability.

It is state policy to promote safety for persons and property connected with the use, operation and equipment of vessels and to promote uniformity of laws relating thereto. The Delaware Commission of Shell Fisheries has jurisdiction to coordinate and supervise implementation of this chapter and to issue appropriate regulations. Most boats operating on state waters must be numbered. An annual application to the Commission for such number is necessary. Motor boats fall within one of four classes and the applicable regulations vary according to the classification. Some regulations, such as the requirement of lights after sunset, are consistent throughout each class. The Commission appoints a Boat Safety Director who supervises implementation of the requirements of this chapter. Owners of boat liveries must keep the names and addresses of persons renting vessels and comply with a number of other special regulations. Special regulations apply to boats towing water skiers. Local regulations may not conflict with this chapter. A vessel owner is liable for damages negligently caused by the operator of his vessel. All peace officers of the state are responsible for enforcement of this chapter. (Johnson-Fla)
W69-07901

DRAINAGE.

Md Ann Code Art 66C sec 64 (1957).

Descriptors: *Maryland, *Administrative agencies, *Drainage engineering, *Drainage programs, Legal aspects, Legislation, Water law, Drainage, Drainage practices, Drainage systems, Land management, Local governments, Federal government.

The State Board of Drainage under the control of the State Board of Agriculture is created and is to be administered by the University of Maryland professor of agricultural engineering who is known as the State Drainage Engineer. The duty of said engineer is to promote and encourage drainage of agricultural lands in the state. He is also to correlate the activities of the local drainage organizations in the state and cooperates with state and federal agencies in the interest of a permanent program of improved drainage. (Johnson-Fla)
W69-07902

LOBSTER, TERRAPINS - DIAMOND BACK AND SALT WATER.
Md Ann Code Art 66C secs 335 thru 341 (1957).

Descriptors: *Maryland, *Turtles, *Lobster, *Regulation, Commercial shellfish, Aquatic animals, Nets, Trapping, Wildlife conservation, Commercial fishing, Legislation, Legal aspects, Breeding, Eggs, Confinement pens, Interstate.
Identifiers: *Salt water terrapins, *Diamond back terrapins, Penalties (Criminal), Closed seasons, Limits, Residence requirements, Evidence, Fines, Enforcement.

Possession, sale or transportation of spawning lobster or any lobster less than 3 1/8 inches in length, measured as prescribed, is unlawful. The taking or possession of any salt water or diamond back terrapins, skilpots or sliders from April 1 to October 31 is unlawful. The confinement of terrapins in pens for the purpose of sale or exchange during the closed season is unlawful. However, water pens may be used by dealers or for confinement for propagation purposes. Terrapin under 5 inches long may not be taken or possessed. Except for propagation purposes, the taking, destruction or possession of terrapin eggs is unlawful. No person shall take or catch terrapin mentioned in this section outside the county of his residence. The possession, or confinement of terrapins in a trap, snare, net or other device is conclusive evidence of violation. Terrapin so found may be confiscated. Violations of this section are finable misdemeanors. One half of the fines recovered shall go to any person (other than state officials charged with enforcement) who procures a conviction under this statute. (Harris-Fla)
W69-07903

DREDGING AND BEACHES.

Del Code Ann tit 23, secs 1701-1708 (1953), as amended, (Supp 1966).

Descriptors: *Delaware, *Dredging, *Beaches, *Construction materials, Administrative agencies, Shores, Legislation, Legal aspects, Water law, Water policy, Earth materials, Particle size, Sediments, Silts, Soils, Construction materials, Coasts, Beds, Submerged land, Regulation, Permits, Beds under water, Ownership of beds, Gravels, Construction, Sands.
Identifiers: Penalties (Criminal), Waters of the state.

It is unlawful to take such materials as earth, dirt, mud, soil, and silt, excavated from under the waters of the state, to any point out of the state. Violators may be fined and their boats or vessels are liable for those pecuniary penalties not paid. Sand, clay and other materials used in building or any other art or trade are excluded from these requirements. No sand may be taken from the beaches between Rehobath and the Maryland State Line. Permission of the State Highway Department is necessary for removal of sand from beaches elsewhere. However, persons need not obtain permission to remove gravel found between high and low water marks so long as it is of a variety suitable for concrete masonry. (Johnson-Fla)
W69-07904

LIBRARY U. OF I., URBANA-CHAMPAIGN

DAMS.

Del Code Ann tit 23, secs 1901-1904 (1953), as amended, (Supp 1966).

Descriptors: *Delaware, *Dams, *Mill dams, *Riparian rights, Legislation, Legal aspects, Water law, Regulation, Jurisdiction, State jurisdiction, Permits, Dam construction, Damsites, River regulation, Water control, Bank erosion, Bank stability, Overflow, Riparian land, Riparian water loss, Streams, Washouts, Banks, Boundaries (Property), Floods, Water levels, Eminent domain.

Subject to regulations in this chapter it is legal to build dams across non-navigable waters for working any mill. No dam which would injure any upstream mill site may be built. The Superior Court has jurisdiction to authorize the building of dams in each county. When earth or gravel necessary for construction or repair of any lawful dam lies adjacent to such dam, the owner of such dam may petition to the Superior Court for condemnation of the materials. The value of such materials will be paid over to the property owner and the dam owner will be allowed to use same for the purpose set out in his petition. A dam owner may enter the land of another to repair the banks of any stream where water has been diverted from the customary banks of the stream to the detriment of the stream owner. Damages which may occur due to such entry or repair are assessable against the dam owner. A dam owner is liable for damages caused by waters forced upon the property of others by his dam. (Johnson-Fla)
W69-07905

STORAGE OF NATURAL OR ARTIFICIAL GAS AND PETROLEUM PRODUCTS IN PRINCE GEORGE'S COUNTY.
Md Ann Code Art 66C secs 691, 692 (1957).

Descriptors: *Maryland, *Natural gas, *Underground storage, *Water pollution control, Pollutants, Maps, Permits, Percolating water, Subsurface waters, Underground streams, Administrative agencies, State governments, Legislation, Bodies of water, Wells, Well permits, Drilling, Contamination (Water), Diversion, Withdrawal, Legal aspects, Jurisdiction, Administrative regulation.
Identifiers: Artificial gas, Injunctions (Prohibitory), Injunctions (Mandatory).

The Department of Geology, Mines and Water Resources, shall restrict storage permits for natural or artificial gas as is necessary to protect state waters, including subsurface and percolating waters. Enforcement of restrictions may be sought through injunctive relief in county circuit courts or Superior Court of Baltimore City. Violations shall be finable misdemeanors. Applications for storage permits shall include a competent engineer's or geologist's map showing location, extent and depth of wells and storage places. A copy shall be sent to the Water Pollution Control Commission for advice thereon concerning possible pollution, contamination, diversion or depletion of subsurface or percolating waters. Testimony may also be taken, and the permit granted or denied subject to Water Pollution Control Commission approval. (Harris-Fla)
W69-07906

DEPARTMENT OF CHESAPEAKE BAY AFFAIRS.

Md Ann Code Art 66C secs 6 thru 13L (1957).

Descriptors: *Maryland, *Administrative agencies, *Water management (Applied), *Water resources development, Commercial fishing, Shellfish, Legal aspects, Legislation, Water law, Water policy, Conservation, Fish management, Jurisdiction, Recreation, Regulation, Water conservation, Water utilization, Competing uses, Fish, Tidal waters, Planning, Area development, Economic efficiency, Permits, Mining.
Identifiers: Penalties.

The department of Chesapeake Bay Affairs is responsible for development, management, planning, and conservation of the Chesapeake Bay and all other tidal waters, the operative arm of which is the Commission on Chesapeake Bay Affairs. All matters relating to fish and shellfish and public recreation facilities in the Bay area, except matters under the jurisdiction of the Department of Game and Fish or the Department of Water Resources are within its jurisdiction. The department may also issue licenses and establish fees for certain purposes, regulate the commercial fishing industry, and perform other activities which tend to promote optimal utilization of the state's seafood resources. The mining of raw materials especially gravel, from such waters, the taking of eels, and quarantine of fish are under the control of the department. Judicial review as provided by the Administrative Procedure Act is available for challenging commission decisions. (Johnson-Fla)
W69-07907

LICENSING OF WELL DRILLERS.

Vt Stat Ann tit 10, secs 1151-1157 (Supp 1968).

Descriptors: *Vermont, *Drilling, *Wells, *Water resources, Logging (Recording), Drilling equipment, Underground, Well permits, Well regulation, Legislation, Administration, Administrative agencies, Subsurface waters, Drilling fluids, Water properties, Chemical properties, Physical properties, Control, Regulation.
Identifiers: Permit fees, Renewal.

Any person wishing to engage in the business of drilling wells for underground waters must apply to the state water resources board for a license. There is an annual fee for such license which must be renewed annually. Each driller must keep records on each water well drilled and file that report with the board within sixty days after the well's completion. Refusal to complete the report may result in revocation of the license. No report need be filed if the well is hand driven or dug by other manual means. Within six months of the filing of the report, the driller must file a report of the physical and chemical analysis of a sample of water from each well drilled. A water resources revolving fund is established from which payments may be made for the accumulation of water resources data and information. Any person aggrieved by a decision of the board may appeal to the county court in the county in which he has his principal place of business. (Shevin-Fla)
W69-07908

BLACK BASS AND PIKE, SPEAR FISHING.

Md Ann Code Art 66C secs 314 thru 319B (1957).

Descriptors: *Maryland, *Fish management, *Fishing gear, *Interstate, Pikes, Bass, Fish conservation, Fish stocking, Sea basses, Walleye, Commercial fishing, Fisheries, Regulation, Sport fishing, Legal aspects, Legislation, Water law, Breeding, Creel census, Equipment, Administrative agencies.
Identifiers: *Interstate commerce, *Fish limits, *Fishing seasons, Penalties (Criminal), Creel limit, Spearfishing, Constitutionality.

The catching of pike in tidal waters from March 15 to April 30 is unlawful. Sale, purchase or possession of pike during this period is unlawful regardless of where caught. All black bass except black sea bass, may be caught only with rod and line and are subject tothe creel limit. All netted black bass, except 5 which may be kept for personal use, must be returned unharmed to the water. Except where allowed by this section, sale, purchase, offers to sell or purchase, and possession of black bass is unlawful regardless of where or in what state caught. Nothing in this section prevents interstate shipment of bass for stocking and breeding purposes. Delivery, acceptance for transportation, or transportation of pike or bass into or from Maryland is prohibited except when allowed by this act. Black bass limits are 5 over 9 inches in length. Pike limits are 10 over 14 inches. The taki wall-eyed pike other than by hook, rod and li the actual or attempted purchase, sale, or tra tation of them from March 15 to November prohibited except where allowed by this se Violations of this section are fi misdemeanors. Unconstitutional portions o section are severable. Spearfishing is lawf regulated by the Game and Inland Fish Co sion and Department of Chesapeake Bay A (Harris-Fla)
W69-07909

CONSTRUCTION OF STATUTES REQUI RAILROADS TO PROVIDE FOR DRAINAGE OR FLOW OF WATERS.

19 ALR 2d 967-1000 (1951).

Descriptors: *Legislation, *Railroads, *Su drainage, *Streams, Bridges, Ditches, Cul Drains, Roadbanks, Embankments, Dikes, T Indiana, Missouri, Vermont, New York, Dam Remedies, Surface runoff, Flood damage, F ing, South Dakota, Natural flow, Obstructi flow, Diversion, Reasonable use, Relative r Legal aspects, Water law.

The manner in which, and the extent to whic drainage or flow of waters may be affected b construction and maintenance of railroads ha in several jurisdictions, to the enactment of sta ry regulations on the subject. Prior to the e ment of statutes concerning this subject, such lations were sometimes included in the corp charters of railroads. Generally, the statutes provide for watercourse outlets through or the roadbed or broadly allude to the require that streams crossed by roadbeds shall not b paired. The scope of this annotation is an an of the duties imposed by these statutes and an ysis of what constitutes compliance therewith issues of liability and remedies for violation of statutes are not so included. Questions conce the use of streams or water and questions of na bility are beyond the scope of the annot (Katz-Fla)
W69-07910

CONSTRUCTION OF STATUTES REQUI RAILROADS TO PROVIDE FOR DRAINAGE OR FLOW OF WATERS.
19 ALR 2d 970-972 (1951).

Descriptors: *Legislation, *Railroads, *Su drainage, *Streams, Bridges, Ditches, Cul Drains, Roadbanks, Embankments, Dikes, T Indiana, Missouri, Vermont, New York, Dam Remedies, Surface runoff, Flood damage, F ing, South Dakota, Natural flow, Obstructi flow, Diversion, Reasonable use, Relative Legal aspects, Water law, Precipitation excess

Arizona requires railroads to restore inters streams to their former state as nearly as possi as not to unnecessarily impair their use or i their franchise. Similarly, Illinois requires rail to restore intersected streams to the precon tion status quo. Iowa requires railroads to ma bridge abutments over streams in good repair. nesota requires railroad ditches and culverts clean during the period of spring thaw. Mis requires a railroad to construct and ma openings through its roadbed. New York req that intersected streams not be deprived of former usefulness. Texas, Vermont and S Dakota also base their respective statute nonimpairment of former usefulness. Gene cases construing these statutes have stress reasonable interpretation. Statutes requiring road to intersect a stream in such a manner as ford security to life and property have been h refer to life and property connected with stream and not solely that of the railroad. How a contrary interpretation has been given in struction of a similar Montana statute. (Katz-F W69-07911

ISTRUCTION OF STATUTES REQUIRING LROADS TO PROVIDE FOR THE INAGE OR FLOW OF WATERS.
LR 2d 972-974 (1951):

riptors: *Legislation, *Railroads, *Surface nage, *Streams, Bridges, Ditches, Culverts, ns, Roadbanks, Embankments, Dikes, Texas, ana, Missouri, Vermont, New York, Damages, edies, Surface runoff, Flood damage, Flood- South Dakota, Natural flow, Obstruction to Diversion, Reasonable use, Relative rights, rian lands, Legal aspects, Water law.

Missouri statute requiring construction and tenance of drainage facilities requires a rail- to construct and maintain its roadbed so as to ent injury to adjacent land. Railroads obstruct- atural drainage must take steps to prevent the low of adjacent land. The contention that the te only intended to cover cases of standing r which might be injurious to health has been ted. The Texas statute on right-of-way age has been construed to prohibit railroads interfering with natural drainage on either of the right-of-way and does not require a rail- to leave excavations on the right-of-way in condition as to prevent the accumulation of r. It has been held that these general statutes ot otherwise materially restrict the measure of otherwise imposed by law on railroads ing streams. These statutes have been termed eclaratory of the common law duty of care. z-Fla)
-07912

ISTRUCTION OF STATUTES REQUIRING LROADS TO PROVIDE FOR THE INAGE OR FLOW OF WATERS.
RL 2d 974-977 (1951).

riptors: *Legislation, *Railroads, *Surface nage, *Streams, Bridges, Ditches, Culverts, ns, Roadbanks, Embankments, Dikes, Texas, ana, Missouri, Vermont, New York, Damages, edies, Surface runoff, Flood damage, Flood- South Dakota, Natural flow, Obstruction to Diversion, Reasonable use, Relative rights, AL ASPECTS, Water law, Riparian lands, Il- s.

Illinois and Texas statutes requiring railroads rovide drainage along rights of way were ted prospectively only. The Missouri statute ly manifests a retroactive intent. The statutory of a railroad to provide adequate drainage is rally held to rest on a subsequent purchaser or r successor in ownership of the railroad. tees in bankruptcy and receivers are bound by statutory duty. The Indiana statute provides edy for adjacent landowners damaged by the oad's neglect without regard to whether the in- l parties were adjacent landowners at the time onstruction. Under Missouri law, a railroad's lity for breach of a drainage requirement te is not limited to adjacent landowners. The ouri statute has been construed to require only the railroad maintain adequate drainage cul- s to facilitate the movement of water into inter- ed streams and does not require a railroad to ntain culverts to facilitate movement of water intersected streams. (Katz-Fla)
-07913

NSTRUCTION OF STATUTES REQUIRING LROADS TO PROVIDE FOR THE AINAGE OR FLOW OF WATERS.
LR 2d 977-982 (1951).

criptors: *Legislation, *Railroads, *Surface nage, *Streams, Bridges, Dikes, Ditches, Cul- s, Drains, Roadbanks, Embankments, Texas, ana, Missouri, Vermont, New York, Damages, edies, Surface runoff, Flood damage, Flood- South Dakota, Natural flow, Obstruction to , Diversion, Reasonable use, Relative rights, rian lands, Legal aspects.

The organization of a drainage district and the levying of an assessment against a railroad does not dispose of its statutory duty to provide drainage facilities. Some general statutes require railroads to maintain openings through roadbeds to connect with ditches, drains or watercourses. Such statutes have been held not to impose a duty to so maintain culverts in the absence of a ditch, drain or watercourse with which connection is possible. A drain, ditch or watercourse does not have to be a running stream to come within the purview of several state statutes to the forgoing effect. Connecting ditches may either be natural or artificial. The statutory duty to provide drainage facilities has been limited, in several cases, to such as are practicable or may be constructed at reasonable cost. (Katz-Fla)
W69-07914

CONSTRUCTION OF STATUTES REQUIRING RAILROADS TO PROVIDE FOR THE DRAINAGE OR FLOW OF WATERS.
19 ALR 2d 982-1000 (1951).

Descriptors: *Legislation, *Railroads, *Surface drainage, *Streams, Bridges, Ditches, Culverts, Drains, Roadbanks, Embankments, Dikes, Texas, Indiana, Missouri, Vermont, New York, Damages, Remedies, Surface runoff, Flood damage, Flooding, South Dakota, Natural flow, Obstruction to flow, Diversion, Reasonable use, Relative rights, Legal aspects, Water law.

Some states impose strict liability on railroads for violation of drainage requirement statutes. However, the majority require a showing of negligence as a condition precedent to liability. Generally, the duty imposed by such statutes is continuing. The statutory duty to restore intersected streams is not limited to navigable streams. Statutes limited to the forgoing restoration have been construed not to impose liability for failure to provide surface water drainage. However, provisions specifically relating to drains, ditches and openings through roadbeds have been interpreted to impose liability for surface water runoff. The construction of bridges, culverts, drains and ditches of adequate size are satisfactory methods of compliance with these statutes. However, construction of such facilities must be in a manner calculated to avoid accumulation of drift or debris. These statutes impose a continuing duty to maintain these facilities. (Katz-Fla)
W69-07915

STATE SHELL-FISHERIES.
Conn Gen Stat Ann secs 26-187 to 26-237 (1960), as amended, (Supp 1968).

Descriptors: *Connecticut, *Shellfish, *Marine fisheries, *State jurisdiction, Legislation, Water law, Legal aspects, Oysters, Clams, Commercial shellfish, Mussels, Ownerships of beds, Boundaries (Property), Jurisdiction, Water rights, Administrative agencies, Local governments, Federal government, Water policy, Invertebrates, Regulation, Adjudication procedure, Boundary disputes.
Identifiers: Penalties (Criminal), Monuments, Markers, Shellfish grounds.

Five commissioners and an engineer constitute the state shell-fisheries commission which has jurisdiction over shell-fish in state waters and is vested with the power to lease certain shell fish grounds. Disputes over boundaries of shell-fish grounds must be taken to the commissioner for settlement. Fees are established for the recording of certain papers and maps including papers which evidence the transfer in ownership of oyster grounds. There is provision for release to the state of oyster grounds, leasing of beacon ground, and buoying of certain natural beds. The enforcement of shell-fish laws, taxation of shell-fish grounds, licensing of oyster vessels, and licensing to work natural beds are duties of the commission. Non-resident oystermen are regulated and there are limitations on the use of power dredges and chain bags. There is provision for designation of shell-fish spawning beds and regulation of mud dumping in waters within the commission's jurisdiction. A license is required for taking conchs and there are certain limitations on digging clams. (Johnson-Fla)
W69-07916

STATE SHELL-FISHERIES.

Conn Gen Stat Ann secs 26-187 to 26-204 (1960), as amended, (Supp 1968).

Descriptors: *Connecticut, *Administrative agencies, *Commercial shellfish, *State jurisdiction, Shellfish, Marine fisheries, Legislation, Water law, Legal aspects, Jurisdiction, Water policy, Regulation, Water resources development, Local governments, Fish management, Ownership of beds, Boundaries (Property), Adjudication procedure, Oysters, Leases, Boundary disputes, Preferences (Water rights), Boundaries (Surface).

An agency of shell-fish commissioners is established and given jurisdiction over all shell fisheries which come under state jurisdiction. Boundary disputes are settled by the Superior Court when there is a conflict between state and local jurisdiction. The commissioners must map natural oyster beds and keep a copy of same available to the public. The commission has the power to lease certain shell-fish areas. Disputes as to ownership of shell-fish grounds are to be settled by the shell-fish commissioners, and surveyors may be hired by the commission to aid in settling these disputes. Appeal of such decisions is available to the superior court. All transfers of title to oyster grounds within state jurisdiction shall be recorded in the office of the shell-fish commission. Owners of grounds designated for oyster cultivation are permitted to release their interests in these grounds to the state under certain conditions. The commission is charged with construction and maintenance of markers of shell-fish grounds within state jurisdiction. Natural oyster beds are distinguished from cultivated beds and the granting of a franchise to take clams or oysters on such beds is illegal. (Johnson-Fla)
W69-07917

STATE SHELL-FISHERIES.
Conn Gen Stat Ann secs 26-205 to 26-216 (1960), as amended, (Supp 1968).

Descriptors: *Connecticut, *Commercial shellfish, *Ownership of beds, *Taxes, Boundaries (Surface), Legislation, Water law, Legal aspects, Clams, Oysters, Shellfish, Regulation, Water policy, Administrative agencies, Water rights, State jurisdiction, Water resources development, Adjudication procedure, Jurisdiction, Financing, Permits, Dredging.

Shell-fish wardens are to be appointed by the commissioners to assist in detecting and prosecuting offenses which violate shell-fish laws. Upon application of the Oysterman's Protective Association of Connecticut or any franchise owner, shell-fish policemen may be commissioned by such association or owner to enforce shell-fish laws. For tax purposes, an owner of a franchise or grounds must deliver a sworn statement of the lot (s) owned by him in order that the value of such property may be determined. The tax rate is two percent of the valuation. Appeal from decisions of the board of tax review may be taken to the court of common pleas. Property may be sold for delinquent taxes or will revert to the state after taxes are in arrears for five years. Oyster boats must be licensed and numbered before any person can take oysters from a natural bed. Each individual upon such a boat is also required to have a license. Owners of boats and crew members must be state residents. Taking of shell-fish by use of power tools is prohibited on natural beds. (Johnson-Fla)
W69-07918

STATE SHELL-FISHERIES.
Conn Gen Stat Ann secs 26-217 to 26-237 (1960), as amended, (Supp 1968).

LIBRARY U. OF I., URBANA-CHAMPAIGN

Descriptors: *Connecticut, *Commercial shellfish, *Administrative agencies, *Regulation, State governments, Local governments, Dredging, Oysters, Shellfish, Permits, Mollusks, Buoys, Spawning, Water law, Legislation, Legal aspects, Inspection, Federal government, Fish management, Preferences (Water rights), State jurisdiction, Ownership of beds, Regulation, Competing uses.
Identifiers: Penalties (Criminal), Mud dumping.

Size requirements are placed on the use of chain bags and net bags. Dredging without a license upon natural oyster beds renders one ineligible for a license for the remainder of the license year. A license is required for taking conchs in excess of five bushels per day. The commission may designate up to ten acre beds as shell-fish spawning areas where taking of shell-fish is prohibited. Mud or refuse dumping may be done by permit only except for work being done by the United States government. Dumping inspectors are to accompany each boat to see that its contents are properly dumped. Depositing starfish, periwinkle, or oysters other than Ostrea Virginica is prohibited. Penalties are provided for unlawfully taking oysters in daytime or at night. Owners are to buoy their shell-fish grounds properly. Oysters may not be gathered between July 20 and September 20 from any natural bed. Clams may not be taken by non-residents. No act concerning the quantity of shell-fish to be taken from natural grounds shall apply in certain specified localities. (Johnson-Fla)
W69-07919

WATER RESOURCES AND THE LEGISLATIVE BRANCH,
Subcommittee on Air and Water Pollution (U. S. Congress).
For primary bibliographic entry see Field 05G.
W69-08040

LEGAL ASPECTS OF WATER REUSE IN TEXAS,
Vinson, Elkins, Weems and Searls, Houston, Tex.
For primary bibliographic entry see Field 05G.
W69-08043

THE PRINCIPLE OF 'FISCAL EQUIVALENCE': THE DIVISION OF RESPONSIBILITIES AMONG DIFFERENT LEVELS OF GOVERNMENT,
Maryland Univ., College Park, Md.
J. Olson, Jr.
American Economic Review, Vol 59, No 2, pp 479-487, May 1969. 9 p, 4 ref.

Descriptors: *Optimization, *Government supports, Taxes, Boundaries, Costs, Marginal costs.
Identifiers: *Fiscal equivalence, *Subsidies, Collective goods, Governmental boundaries, Allocative efficiency, Free bargaining.

With most of the functions in the water resource area being performed by government agencies, the attempt by this article to form an economic basis for deciding what type of government should perform those activities that require collective action, should prove useful to the water researcher. The present pattern of governments is duplicative and unsatisfactory. In line with this, the deficiencies of free bargaining among concerned parties in dealing with externalities in a Pareto optimal way, is discussed. A basis for a larger model is then worked out by focusing on the problem of allocative efficiency and the necessary conditions for its existence. This involves a discussion of the beneficial limits of a collective good and the boundaries of the government providing it. The author also studies the influence of economies and diseconomies of scale in the production of collective goods the effect of the scale of government on the optimal mix of governmental institutions. The conclusion warns of some of the dangers of going directly from theory to policy. (Murphy-Rutgers)
W69-08067

LEGAL ASPECTS FOR CONTROL OF INTRASTATE, INTERSTATE AND INTERNATIONAL WATERS,
Michigan State Assistant Attorney General.
Nicholas V. Olds.
The Fresh Water of New York State: Its Conservation and Use, pp 116-123, Wm C Brown Book Co, Dubuque, Iowa, 1967. 8 p, 15 ref. Edited by Lauren B. Hitchcock.

Descriptors: *Legal aspects, *Water control, *Great Lakes, Administration, Harbors, St. Lawrence Seaway, Water management, Federal Government, Boundary disputes, Michigan, Ohio, Lake Erie, Minnesota, Wisconsin, Navigation, Recreation, Water pollution.
Identifiers: Interstate problems, Intrastate problems, International problems, Lake levels, Ownership, Deep draft ocean navigation, International government, Pilotage, Tolls.

The Great Lakes constitutes the greatest body of fresh water in the world and is considered one of the greatest waterways. The basin encompasses eight states, two provinces and two nations. Many intrastate, interstate and international problems of a highly complex nature need to be resolved. In the past there have been boundary disputes settled both by Supreme Court decisions and interstate compacts. The international boundary has been subject to many treaties and is fixed by an International Boundary Commission. Other problems of the Great Lakes, many having economic aspects, concern lake levels, the ownership of natural resources, the construction of ports and harbors, the deepening of channels and the construction of the St. Lawrence Seaway which opened the Great Lakes to deep draft ocean navigation. It is argued that the eight Great Lakes states as well as the two Canadian provinces should play their rightful role in the management and regulation of these water resources in cooperation with federal and international governments and entities. (See W69-08076). (Loeb-Rutgers)
W69-08080

THE COLUMBIA RIVER TREATY, THE ECONOMICS OF AN INTERNATIONAL RIVER BASIN DEVELOPMENT,
Resources for the Future, Inc., Washington, D. C.
For primary bibliographic entry see Field 06B.
W69-08084

WESTERN WATER LAW AND CONFLICTS BETWEEN THE STATES AND THE FEDERAL GOVERNMENT,
Hatfield Chilson.
Resources Development: Frontiers for Research, pp 193-202, University of Colorado Press, Boulder, 1960. 10 p. Edited by Franklin S. Pollak.

Descriptors: *Water law, Control, Water resources, Water supply, Federal Government, Desert Land Act.
Identifiers: *Western water law, *Conflicts, *Doctrine of appropriation, State control, Western States, Pelton Dam case, U S Supreme Court, Nebraska v Wyoming.

This paper deals with the water resource originating in the area of the United States lying west of the 98th meridian, commonly referred to as the Western States. Except in areas such as the Pacific Northwest, the Western States are arid or semiarid, the water supply scarce and therefore extremely valuable. Consequently, competition for the use of the limited water supply began with the settlement of the West and continues at an accelerated pace. This competition has led to innumerable controversies and conflicts among water users, and as a result there has developed in the Western States, over a period of more than one hundred years, a body of constitutional provisions, statutues, and court decisions governing water, its use and disposition. This body of law constitutes what is known as Western water law, and the backbone of this law is the doctrine of appropriation, which is discussed in detail. (See also W69-08088). (Loeb-Rutgers)
W69-08090

DESIRABLE REVISIONS OF WEST WATER LAW,
Wyoming Univ., Laramie.
Frank J. Trelease.
Resources Development: Frontiers for Rese pp 203-216, University of Colorado Press, Bou 1960. 14 p, 15 ref.

Descriptors: *Water law, Economics water su Colorado, Wyoming, Texas, Montana, W rights, Groundwater, Risks.
Identifiers: *Western water law, Private ri West, Rightful claimant, Records, Te Semipublic districts, Public interest, Permit sys

The theme for this paper was that econo should play a larger part in water allocation. O the author's basic criteria was that any law vocated must be a law that has worked in area. The author contends that the greatest for water law research is not in the cases statute books, but in the administrative offices in the field. Studies of the specific problem specific basins are needed to give us case repo a sort other than the results of litigatio economics is to play an important part in the perhaps lawyers should study economics economists should study law. An important st this direction, and in the direction of specific dies of particular basins, has been undertake the Western Regional Research Committee W financed by the Federal Government and coop ing state agricultural experiment stations. Mo this is needed. If administrators are to c master plans for water resources and are to ch intelligently between competing projects, they need economic and legal help. (See W69-080 (Loeb-Rutgers)
W69-08091

OUR NATION'S WATER RESOURCES--P CIES AND POLITICS,
Chicago Univ., Ill.
For primary bibliographic entry see Field 06B.
W69-08094

THE STUDY OF WATER RESOURCES GANIZATIONS AS POLITICAL SYSTEMS,
Michigan Univ., Ann Arbor. Dept. of Poli Science.
Robert H. Pealy.
Johns Hopkins University, Water Manage Seminars, pp 236-252, October 1964 to May 1 17 p, 23 ref.

Descriptors: *Political aspects, *Water resou development, river basin commissions, Motiva administrative agencies.
Identifiers: Ideology, Arkansas-White-Red Ba Inter-Agency Commission, U.S. Study Com sion, Southeast River Basins.

The thesis, that governments are political syst and organizations, and that organizations government and, therefore, political systems, i amined vis-a-vis water resource organizations. author contends that water resources planning development functions may be in part governe a political or functional sub-culture and that sub-cultures have a great deal to do with policy comes. The article is based on the proposition there is a legitimate sphere for the operatio political phenomena in water resources orga tion, and that the study of this phenomena ca profitable. Recent research indicates that m changes in formal organizations and struct would make rational planning for the develop of water resources possible. However, institut (i.e., Congress, water agencies, and clientele) r major changes with the result that only increme changes have occurred. While these increme changes have cumulatively produced substa changes, there has been little effort to syste cally evaluate the effects or the efficiency of t changes. The author takes issue with the wi

notion that if only political forces could be nted from interfering, plans and projects that benefit the public interest would ensue. A dology is developed for analyses of water rce organizations that is based on role analysis mining the policy process. The major policies ee organizations are described and analyzed: Arkansas-White-Red Basins Inter-Agency nittee (AWRBIAC); Texas; and Southeast Basins. The findings presented the influences e expectations, orientations, ideology and ptions of relevance in the making of policy in resources organizations. (Starr-Chicago) 08100

ER RESOURCES LAW - POLICIES, HANISMS AND DOCTRINES,
ning Univ., Laramie. Coll. of Law.
J. Trelease.
Hopkins University, Water Management ars, pp 317-330, October 1964 to May 1965. ref.

iptors: *State jurisdiction, *Federal jurisdic- Federal-state water rights conflict, Riparian , Prior appropriation, Public benefits, Public Optimum development plans.
fiers: Maximization, Optimum good.

is viewed by the author as the machine shed by man to accomplish the aims of man. ed are the policies behind the law, the anisms it uses and how these are translated octrines vis-a-vis water resources. These laws vided into three categories and described: (1) vater law -- the maximization or optimization ; (2) federal water law -- national policies; (3) state-federal conflicts. The positive s of these types of water resource laws are d; however, recognition is given to the fact ws often do not meet the goal of optimum re often barriers to desirable action, and fall of producing optimum utilization of waters. law reflects the needs and desires of the peo- d their legislators, it is essential that informa- e disseminated to enlighten the public so they create the pressures for changes in the law isting institutions. (Starr-Chicago) 08102

E ASPECTS OF PUBLIC ORGANIZATION WATER MANAGEMENT,
use Univ., N. Y. Dept. of Political Science.
e C. Martin.
Hopkins University, Water Management ars, pp 253-263, October 1964 to May 1965. 11 ref.

iptors: *Regional analysis, *Administrative ies, Federal project policy, Inter-agency ration, St. Lawrence River Commission, Ten- Valley Authority Project, Water resources pment.
fiers: *Special districts.

rticle is a discussion of water management as ucial step in a water program. An examina- f the governmental organization available for management responsibilities is done and an ption is made that water resources adminis- n is a new function of government and one is extremely difficult to fit into the tradi- framework of government. Regional ad- ration as at least a partial answer to the ems of water management is considered. The em of defining a region is noted -- a geog- r views a region differently than a public ad- rator. The author defines a region as an ad- rative region, one that does not fit into the onal pattern of government in this country. resources management regions, for the sake s examination, are divided into four major ories: (1) intrastate action; (2) interstate ac- (3) federal regional water agency (TVA) -- watershed; and, (4) international agreement awrence). Recognized are the limitations on gion as a geographical basis for public or- ganization. Because there is nothing better available, special ad hoc arrangements handle most water resources management efforts. These are usually single-purpose special districts. No viable alternative to the special district has been proposed so this trend is likely to continue. (Starr-Chicago)
W69-08103

BACKGROUND OF THE WATER RESOURCES PROBLEM,
Resources for the Future, Inc., Washington, D. C.
For primary bibliographic entry see Field 06B.
W69-08106

WHY MANAGE WATER,
Johns Hopkins Univ., Baltimore, Md.
Abel Wolman.
Johns Hopkins University, Water Management Seminars, pp 3-12, October 1964 to May 1965. 10 p, 4 ref.

Descriptors: *Federal project policy, *Institutional constraints, *Political aspects, *Social aspects, Tennessee Valley Authority Project, Benefit-cost ratio.

The dominant hypotheses in the history of water development are reviewed from the emphasis upon economics in the interval from 1930 to 1940 to the present emphasis upon water quality. An analysis of past and present development indicates that the use of water must be a function of time and of the social purposes of the era. The management problems of water are described as being involved in kenetic planning -- any static plan for present and future objectives is marked for failure. At the present time the benefit-cost ratio may no longer be as valid a basis for water management to meet pressures of a socio-political nature. The TVA direction of total basin management and control is cited as a successful effort whose example has not been transferred to other river basins in the United States. The river basin as a topographic and hydrologic unit is seen as having validity but whether it provides a logical way to provide economic, political and social development is doubtful. The author predicts that regional emphasis may dislodge basin emphasis. Meter problems in metropolitan complexes are intensified not because of a shortage of water but because of lack of machinery for management and finance, which stems from lack of previous planning and from the existence of multiple responsibilities and competitive political units of government. National water policy is seen as developing in an ad hoc fashion and tempered by political doctrines and presents the greatest challenge for improvement to the professional. (Starr-Chicago)
W69-08107

WINDFALL GAINS FROM TRANSFER OF WATER ALLOTMENTS WITHIN THE COLORADO-BIG THOMPSON PROJECT,
Economic Research Service, Washington, D. C.; and Colorado State Union, Fort Collins.
Raymond L. Anderson.
Land Economics, Vol. 43, No 3, pp 265-273, August, 1967. 9 p, 6 ref.

Descriptors: *Allotments, Water rights, Legislation, Economics, Economic justification, Water utilization, Economic efficiency, Third party effects, Marginal utility, Domestic water, Irrigation water.
Identifiers: *Windfall gains, Colorado-Big Thompson project.

The paper defends existing legislation that allows owners of water rights developed under government financed projects to capture a windfall gain when they sell property. The paper evaluates the argument for recapturing windfall gains for the government. If an allotment holder no longer has use for the water and desires to sell it, he should not gain a windfall; however, very seldom does an allotment holder have no further use for his water. Selling an allotment is a negotiation between users, not a user and a non-user. The purposes of the Colorado-Big Thompson project are not violated by the transfer of allotments. Efficiency gains from transfer are discussed. So long as third parties are unaffected by trade, trading of allotment will tend to the greatest possible efficiency. The economic argument for allowing continued transfer of Colorado-Big Thompson allotments is based on marginal value. Whenever marginal value in use is greater in one employment than another, resources should move from lower value uses to higher value uses. Domestic water users in the Colorado-Big Thompson project have a considerably higher valued demand than irrigation users. (Gossen-Chicago)
W69-08111

A LEGAL-ECONOMIC ANALYSIS OF ADMINISTRATIVE AND MARKET PROCEDURES USED IN THE TRANSFER OF WATER RIGHTS,
Nebraska Univ., Lincoln. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 06C.
W69-08115

6F. Nonstructural Alternatives

THE VALUE OF WATER IN ALTERNATIVE USES WITH SPECIAL APPLICATION TO WATER USE IN THE SAM JUAN AND RIO GRANDE BASINS OF NEW MEXICO.
New Mexico Univ., Albuquerque.
For primary bibliographic entry see Field 06B.
W69-08087

THE PERCEPTION OF NATURAL HAZARDS IN RESOURCE MANAGEMENT,
Toronto Univ., (Ontario); and Clark Univ., Worcester, Mass.
For primary bibliographic entry see Field 06B.
W69-08099

6G. Ecologic Impact of Water Development

DEVELOPMENT IN THE POOR NATIONS: HOW TO AVOID FOULING THE NEST,
Luther J. Carter.
Sci, Vol 163, No 3871, pp 1046-1048, Mar 1969. 3 p.

Descriptors: *Environment, *Environmental effects, *Ecology, Planning, Natural resources, Policy matters, Reservoirs, Water pollution, Hazards, Conservation, Pesticides, Resource conservation, *Resource development, Disasters, *Water resources development, Foreign projects, *River basin development, Health, Wildlife, Habitats.
Identifiers: Economic growth, Developing countries, International projects.

Development has always carried a connotation of something necessarily good and representing progress. Little thought has been given to environmental problems arising from development. The price of development has included pollution, loss of farmland and habitat for people and wildlife, and the spread of disease. Some environmental disruption is unavoidable in development, but ecological studies and careful-planning case histories show destructive consequences from development in the Amazon Basin of Brazil, the Kariba Dam between Zambia and Rhodesia, the Aswan High Dam in Egypt, the Canete Valley of Peru, and the Oceanic Islands. A 3-day conference was held near Washington, D C, in 1968, on the ecological aspects of international development. The divergent views on conservation and exploitation expressed at the meeting by agricultural scientists, ecologists, and economists are summarized. (USBR)
W69-07773

LIBRARY U. OF I., URBANA-CHAMPAIGN

THE CONCEPTUAL FORMULATION AND MATHEMATICAL SOLUTION OF PRACTICAL PROBLEMS IN POPULATION INPUT-OUTPUT DYNAMICS,
Department of Agriculture, Ottawa (Canada). Statistical Research Services.
K. E. F. Watt.
Symp Bristish Ecological Soc, March 28-31, 1960, Durham, England. In the exploitation of Natural Animal Populations, LeCren, E D and Holdgate, M W (eds), John Wiley and Sons, Inc, New York, pp 192-203, 1062. 40 ref.

Descriptors: *Biomass, *Productivity, *Yield equations, Optimization.
Identifiers: *Productivity models, *Exploited populations, Resource management, Population ecology.

In the face of an expanding population, resource management will depend on precise estimates of the production of renewable natural resorces and determination of how maximum levels of production can be attained and maintained. A review of examples of exploited populations presents certain problems common to all: maximization of a sustainable yield, harvesting techniques, rhythmic cycles in productive systems, time lag between manipulation and results, differing rates of efficiency, the multiplicity of factors governing biological productivity, and the multiplicity of causal pathways by which productivity is modified. The maximum biomass yield that is repeatedly sustainable per unit time is equal to the total biomass produced in that interval minus that biomass needed to guarantee replacement of the yield in the next interval of time. A sample set of equations is developed for this relationship, leading to a yield equation which incorporates density effects on fecundity and reproduction. An introduction to the mathematical literature in optimization and maximization procedures is given. (Voigtlander-Wisc)
W69-07816

ECOLOGICAL HISTORY OF THE ENGLISH LAKE DISTRICT,
For primary bibliographic entry see Field 02H.
W69-07828

THE HUMAN ECOLOGY OF COASTAL FLOOD HAZARD IN MEGALOPOLIS,
Toronto Univ. (Ontario), and Clark Univ., Worcester, Mass.
Ian Burton, Robert Kates, and Rodman Snead.
Contract No NONR 4043 (00), NR 388-073. Chicago Univ Dep Geogr Res Pap No 115, 1969. 196 p, 51 fig, 47 tab, 89 ref.

Descriptors: *Flood damage, *Storms, *Waves (Water), *Coasts, Beach erosion, Flood protection, Non-structural alternatives, Zoning, Recreation, Land use, Industries, Land management, Urbanization.
Identifiers: *Coastal flooding.

The effects of storm flooding on human use of the Atlantic coast of the U.S. from Maine to South Carolina were studied using aerial photographs, surveys, case histories, and economic surveys. The extent of development, patterns of use, human adjustment to flooding, methods of adjustment to hazard, and shore-use policy and regulation are discussed. (Knapp-USGS)
W69-07942

A SYMPOSIUM ON ESTUARINE FISHERIES.
American Fisheries Society, Washington, D. C.
For primary bibliographic entry see Field 02L.
W69-07986

07. RESOURCES DATA

7A. Network Design

NATIONAL REFERENCE LIST OF WATER QUALITY STATIONS, WATER YEAR 1969.
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 05G.
W69-07941

APPLICATION OF THE HYDRAULIC ANALOGY TO FIELD AMPLIFIER DESIGN (FRENCH),
Department of Sciences, Toulouse (France).
For primary bibliographic entry see Field 02A.
W69-08020

7B. Data Acquisition

THE RESULTS OF CONTINUOUS BED LOAD MEASUREMENTS RELATED TO FLUCTUATIONS OF THE RIVER BED,
Netherlands Rijkswaterstaat, Arnhem. Section of River studies.
For primary bibliographic entry see Field 02J.
W69-07762

SEDIMENT TRANSPORTATION AND THE MEANS OF ITS ESTIMATION,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02J.
W69-07763

THIRTY YEARS EXPERIENCE WITH FIELD INSTRUMENTATION OF EARTH DAMS,
Bureau of Reclamation, Denver, Colo.
Fred C. Walker.
Pap, 18th Annu Soil Mech Conf, Lawrence, Kans, Mar 1969. 20 p.

Descriptors: *Earth dams, *Instrumentation, Dam design, Dam failure, Dam foundations, *Performance tests, Performance, Structural behavior, Earthquakes, Measuring instruments, Settlement, Pore pressure, Seepage, Field tests, Piezometers, Benefits.
Identifiers: Rapid drawdown.

The 3 main reasons for instrumenting an earth dam are: (1) to learn whether the structure performs as anticipated, (2) to monitor the continuing performance, and (3) to increase the knowledge of forces that act on a structure. Much sophisticated and exotic equipment is available for research instrumentation, but a simple instrumentation system is adequate for most routine structures. Collecting and evaluating performance data are continuing operations. The process produces critical and interesting data so infrequently that without special effort an installation may be neglected or abandoned before an event occurs that produces significant results. An earth dam has 3 principal properties whose variation during the life of the structure is of interest: resistance to water movement, resistance to deformation, and strength. The general principles by which data collected from an instrument system can be analyzed to produce an understanding of behavior are described. A few of the more noticeable behavior observations are described and opportunities for further expansion of structural behavior through structure instrumentation are listed. (USBR)
W69-07771

NUCLEAR METHODS IN AIR AND WATER POLLUTION ANALYSIS,
Louisiana State Univ., Baton Rouge.
For primary bibliographic entry see Field 05A.
W69-07782

THE FACET METHOD,
Losinger and Co., Bern (Switzerland).
Peter Benz.
Int Civ Eng, pp 34-37, Jan 1969. 4 p, 6 fig, 3 t

Descriptors: *Cuts, *Excavation, *Estim
Construction, Earth, Foreign design prac
Foreign construction, Surveying, Boundaries
faces), Volume, Surfaces, Terrain, *Fills, P
Civil engineering.
Identifiers: Switzerland, *Surface area.

The facet method is described for calculating volumes in construction, such as foundatio cavation, cuts and fills, and areas of surface method requires no special knowledge and c used by anyone capable of reading a plan h elevation lines. Irregular natural terrain fe are represented by a faceted surface compos triangular planes. The surface area of the ter calculated by summing the areas of the tria Volumes are calculated by summing the volu right triangular prisms lying between the surf the terrain and a reference plane. Tabulatin for computer processing is discussed. The method was developed at Schiffenen Dam, Sw land, for quantity surveys of (1) mass excav (2) rock surface area cleaned before concr and (3) concrete work. (USBR)
W69-07791

SAMPLER FOR STUDIES OF THIN HORI TAL LAYERS,
Washington Univ., St. Louis, Mo. Dept. of Bot
Bruce C. Parker, George Leeper, and William Hurni.
Limnol and Oceanogr, Vol 13, No 1, pp 172 January 1968. 3 fig, 3 ref.

Descriptors: *Sampling, *Thermal stratific *Laboratory tests.
Identifiers: *Water sampler, *Horizontal l *Instrument sampling pattern, Sampling Sampling head slit, Tygon connector tubing, Pump, Thermistor probe, Dye solution pat Torus, Continuous collecting.

Procedure for constructing a water sample can locate a thermally stratified layer and col sample is described. The assembly consists o polypropylene funnels connected by a c mounted screw enabling adjustment of the pling slit. Attached to the upper cone is the perature sensing apparatus, a thermistor att by a Bakelite support and connected microphone cable. The entire apparatus is po and can sample continuously or from a single Laboratory tests conducted to check the effe ness of the device showed that the conical sha the sampling head caused little disturbance moved vertically through water. A tentative clusion is that the sampling pattern of the i ment resembles either a torus or a toroid wi expanded horizontal dimension. Assuming former, the device should be more efficient than open-ended, vertical samplers for volume samples. Considering the increased sectional diameter of the toroidal sampling pa when samples exceed a few liters from a horiz layer, a sampling head of greater diamet horizontal movement of the sampling head m necessary to avoid contamination. (Ketelle-W
W69-07829

RADIONUCLIDE CYCLING BY PERIPHY AN APPARATUS FOR CONTINUOUS IN MEASUREMENTS AND INITIAL DATA ZINC-65 CYCLING,
Battelle-Northwest, Richland, Wash. P Northwest Lab.
For primary bibliographic entry see Field 05C.
W69-07862

BIODIALYSTAT: NEW SAMPLER FOR SOLVED ORGANIC MATTER,
Washington Univ., St. Louis, Mo. Dept. of Bot
For primary bibliographic entry see Field 05A.
W69-07865

SITU MEASUREMENT OF THE FREE RGY OF SOIL MOISTURE BY SMALL ROMETERS (PART 1),
o Univ. (Japan). Disasters Prevention arch Inst.
o Okunishi.
Disaster Prev Res Inst, Kyoto Univ, Vol 18, 3, No 142, pp 17-27, Feb 1969. 11 p, 9 fig, 2 10 ref.

riptors: *Soil moisture meters, *Unsaturated , *Free energy, *Electrodes, Moisture tension, ture content, Hygrometry, Measurement.
tifiers: Magnetite hygrometers.

all hygrometer with a sensing element made of netite colloid was tested in the laboratory and ield to decide the range of the free energy of oil moisture within which it can be used with ntage. The results of the tests and the com- on of the different methods for the in situ mea- ment led to the conclusion that the hygrometer e best method within the range from pF 4 to pF Knapp-USGS)
-07932

LICATION OF MATERIAL AND ENERGY ANCES TO GEOTHERMAL STEAM DUCTION,
s A and M Univ., College Station; and Stan- Univ., Calif.
ert L. Whiting and Henry J. Ramey, Jr.
trol Tech, pp 893-900, July 1969. 8 p, 5 fig, 1 8 ref, append.

riptors: *Geothermal studies, *Steam, *Heat , *Thermodynamics, *Thermal power, Ther- springs, Geysers, Water vapor, Thermal power- ts.
tifiers: Geothermal wells, Geothermal steam s.

e basin thermodynamic principles are ented that are applicable to geothermal fluid rvoir engineering. The equations are useful for nating the initial reservoir conditions and for ching the past performance and predicting the re performance of reservoirs for which the as- ptions involved are realistic. Further, it is onstrated that this approach can be applied to ld case with what appears to be excellent accu- . Other common reservoir engineering tools be modified for application to geothermal fluid rvoirs. (Knapp-USGS)
-07990

IRONMENTAL STUDIES USING EARTH ITAL PHOTOGRAPHY,
Federal Systems Div., Gaithersburg, Md.
Wobber.
ogrammetria, Vol 24, No 3-4, Spec Issue, pp 165, June 1969. 159 p, 35 fig, 2 plate, 3 tab, 26

riptors: *Photogrammetry, *Satellites (Artifi- , Aerial photography, Surveys, Synoptic analy- Geomorphology, Exploration, Mapping, Spec- opy, Hydrologic data.
tifiers: Water resources surveys, Hydrologic ys.

tal remote sensing, and particularly orbital ography, can provide immediately useful data cientists familiar with applying aerial photo- ic techniques to environmental problems. ite the expansion of analytical techniques in arth sciences, the environmental data base has ined relatively static compared with increased mation needs because of the difficulty of ef- ve worldwide surveys and the high cost of y data collection. Color, color infrared, and and white space photographs obtained in the ini and Apollo programs provide unique tic tools for analyzing modern environments processes, and data that cannot be duplicated erial photographic mosaics. Principal ad- ges of orbital surveys include repetitious wide coverage promising environmental synthesis within the full spectrum of seasonal contrasts, and synoptic observations on a scale generally impossible from aircraft. The general categories of environmental data that can be extracted from orbital photography are summarized. Worldwide surveys of marine sedimentation related to offshore bar or reef development can improve navigational safety and coastal engineering activities and provide data related to sediment movement critical to fish migration or reproduction or the hydrodynamics of pollutant movement. Gemini photo-analysis of sediment patterns often show a marked correlation with bathymetric maps and marine bottom topography and suggests surveys of nearshore marine distributary currents may speed location of heavy metal concentrations on the world's continental shelves. (Knapp-USGS)
W69-07992

DISPERSION AND REACTION IN UNSATURATED SOILS APPLICATIONS TO TRACERS,
Grenoble Univ. (France). Laboratoires de Mecanique des Fluides.
For primary bibliographic entry see Field 02G.
W69-07995

WATER CONTENT MEASUREMENT WITH ^{60} keV GAMMA RAY ATTENUATION,
Agricultural Univ., Wageningen (Netherlands); and Technical Univ. of Prague (Czechoslovakia).
P. H. Groenevelt, J. G. de Swart, and J. Cisler.
Bull Int Ass Sci Hydrol, Vol 14, No 2, pp 67-78, June 1969. 12 p, 9 fig, 5 ref.

Descriptors: *Soil moisture meters, *Nuclear moisture meters, *Instrumentation, Nuclear meters, Gamma rays, Spectrometers, Absorption, Porosity.
Identifiers: Gamma attenuation moisture meters, Americium, Gamma-ray spectrometers.

The specific problems dealing with the use of Americium 241 for measuring the water content of soil sample by attenuation of low energy gamma rays are discussed. One of the advantages is that the optimum thickness of the soil sample is about 4 to 5 cm. However, one of the difficulties encountered is related to the determination of the absorption coefficient, which is generally lower than the theoretical value. Special attention is drawn to the problems of counting-losses in the gam10bma spectrometer system. Experimental results are presented showing the importance of the system geometry. (Knapp-USGS)
W69-07997

SOME CONSIDERATIONS ON THE EMPLOYMENT OF TENSIOMETERS (FRENCH),
Toulouse Univ. (France). Institut de Mecanique des Fluides.
L. Sormail.
Bull Int Ass Sci Hydrol, Vol 14, No 2, pp 79-94, June 1969. 16 p, 7 fig, 3 tab, 8 ref.

Descriptors: *Tensiometers, *Soil moisture meters, Moisture tension, Instrumentation, Research and development, Moisture content, Soil moisture, Calibrations, Measurement.
Identifiers: Tensiometer calibration and testing.

The interpretation of tensiometer measurement requires special knowledge of the mechanics of equilibrium of the tensiometer with its environment. The classical concept of response time of the system consisting of a porous cup and a manometer can be improved by taking into account the elasticity of the tubing. The role of entrapped air in the circuit is analogous to tubing elasticity. In general, it is possible to study the response characteristics of the tensiometer by imposing pressure steps on the system and by studying the equilibrium response. Such tests showed certain anomalies of behavior which can be attributed to very small bubbles of air entrapped to the internal wall of the porous cup. However, it is necessary to check the response of the tensiometer when it is placed in the soil. This is confirmed by analysis and experiments in sandy and clay soils. (Knapp-USGS)
W69-07998

A MATHEMATICAL FUNCTION FOR DESCRIBING CAPILLARY PRESSURE-DESATURATION DATA,
Manitoba Univ., Winnipeg. Dept. of Agricultural Engineering.
G. E. Laliberte.
Bull Int Ass Sci Hydrol, Vol 14, No 2, pp 131-149, June 1969. 19 p, 11 fig, 2 tab, 7 ref.

Descriptors: *Soil water movement, *Statistical models, Capillary conductivity, Drainage, Hysteresis, Capillary action, Probability, Porosity, Pores, Saturation, Moisture content.
Identifiers: Probability density function.

The equations of Brooks and Corey for relating effective saturation to capillary pressure describe experimental data quite well for small values of saturation but overestimate pressure as saturation approaches unity. Using assumed functions for the distribution of pore volume with respect to pore radius, Brutsaert was able to describe experimental data satisfactorily, provided that constants such as mean pore radius and the standard deviation of pore radius were determined from distribution functions derived from experimental data, rather than from the assumed functions. White developed a mathematical model which described experimental data satisfactorily but the technique required the determination of 13 constants describing the relationship. In this paper, a pore-volume probability density function is introduced which permits the development of a function for describing effective saturation in terms of dimensionless capillary pressure, that is, capillary pressure scaled in terms of bubbling pressure. The capillary pressure-saturation data on the drainage cycle are described better by the new function than by the equations of Brooks and Corey. The correspondence between experiment and theory is better at small values of saturation than for values approaching unity. The relationship between saturation and pressure is characterized by 3 constants, each of which is, in turn, a function of the pore-size distribution index. Two of the constants are related to mean pore radius and to the standard deviation of the pore-volume distribution. (Knapp-USGS)
W69-07999

GROUNDWATER STUDIES IN THE SABI VALLEY, RHODESIA, USING NATURAL TRITIUM MEASUREMENTS,
Agricultural Research Council of Central Africa. Hydrology Research Team.
For primary bibliographic entry see Field 02F.
W69-08004

ULTRASONIC FLOWMETERS FOR MEASURING RIVER TURBULENCE,
Kyoto Univ. (Japan). Disasters Prevention Research Inst.
Yasuo Ishihara, and Shoitiro Yokosi.
Bull Disaster Prev Res Inst, Kyoto Univ, Vol 18, Part 3, No 144, pp 49-64, Feb 1969. 16 p, 17 fig, 2 photo, 9 ref.

Descriptors: *Flowmeters, *Turbulence, *Ultrasonics, Turbulent flow, Instrumentation, Eddies, Streamflow, River flow.
Identifiers: Ultrasonic turbulence meters.

Two kinds of ultrasonic flowmeters have been developed for the precise measurement of turbulent velocity in streams. One is based on the circuit transit-time method, and the other on the method of phase difference. The circuit transit-time method is able to measure 2 components of velocity simultaneously. These flowmeters have a number of excellent features: high sensitivity, low inertia, complete linearity, high stability, and independence of temperature variation. The characteristic size of the sensor of both flowmeters is only

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3 cm. An adequate combination of the sensors of both flowmeters makes it possible to measure 3 components of turbulent velocity simultaneously. The principle of operation, instrumentation, calibration and several problems are described. The effect of sensor size and the duration of observation on measured spectrum are discussed and a brief description of observations using the flowmeters is presented. (Knapp-USGS)
W69-08017

7C. Evaluation, Processing and Publication

SOLUBILITY OF GYPSUM IN AQUEOUS ELECTROLYTES AS AFFECTED BY ION ASSOCIATION AND IONIC STRENGTHS UP TO 0.15M AND AT 25 DEG C,
California Univ., Davis. Dept. of Water Science and Engineering.
For primary bibliographic entry see Field 02K
W69-07700

HYDROGRAPH SYNTHESIS BY DIGITAL COMPUTER,
Texas A and M Univ., College Station. Dept. of Meteorology.
For primary bibliographic entry see Field 02E.
W69-07706

TIME SERIES ANALYSIS OF HYDROLOGIC DATA,
Arizona Univ., Tucson. Office of Hydrology and Water Resources.
Chester C. Kisiel.
Advance in Hydroscience, Vol 5, pp 1-119, 1969. 119 p, 54 fig, 10 tab, 171 ref.

Descriptors: *Statistical methods, *Model studies, *Stochastic processes, *Time series analysis, *Hydrologic aspects, Computer models, Statistical models, Linear programming, Fourier analysis, Correlation analysis, Regression analysis, Synthetic hydrology.
Identifiers: Spectral analysis, Harmonic analysis.

The use of time series analysis for the study of hydrologic data is discussed in a thorough introduction to mathematical model-making techniques. A bibliography of 171 references is included. Spectrum analysis is a powerful tool for the organization and implementation of field data collection programs. Time series analysis techniques recognize the variability of natural events and the presence of noise. Model studies must incorporate much of the complexity of natural events and detect nonlinear and nonstationary components of natural processes; however, many problems may be studied by the simplifying assumption of stationary stochastic inputs into linear time-invariant systems with stationary stochastic outputs. For main entry see W69-07723. (Knapp-USGS)
W69-07724

QUALITY OF SURFACE WATERS FOR IRRIGATION IN WESTERN STATES--1964.
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 03F.
W69-07732

WATER RESOURCES OF THE BELLE RIVER BASIN, SOUTHEASTERN MICHIGAN,
Geological Survey, Washington, D. C.
R. L. Knutilla.
Geol Surv Hydrol Invest Atlas HA-317, 1 sheet, 1969. Text, 5 fig, 7 map, 2 tab.

Descriptors: *Water resources, *Michigan, *Surface waters, *Groundwater, Streamflow, Water wells, Water yield, Aquifers, Glacial drift, Water quality, Water levels, Water sources, Hydrologic data.
Identifiers: Belle River Basin (Mich).

The water resources of the Belle River Basin, southeastern Michigan are described in a 1-sheet hydrological atlas consisting of maps, graphs, tables and text. Streamflow is summarized and tabulated. Groundwater is obtained mainly from glacial drift deposits, in which yields may be over 100 gpm. Bedrock wells in the western end of the basin yield as much as 100-500 gpm, and in the eastern end yields are commonly less than 10 gpm. Some water from bedrock wells in the eastern part of the basin is too salty for most uses. (Knapp-USGS)
W69-07734

FLOODS AT AMESVILLE, OHIO,
Geological Survey, Washington, D. C.
Ronald I. Mayo, and Earl E. Webber.
Geol Surv Hydrol Invest Atlas HA-324, 1 sheet, 1969. Text, 6 fig, 1 map, 1 tab, 2 ref.

Descriptors: *Floods, *Ohio, *Stage-discharge relations, Discharge (Water), Streamflow, Hydrographs, Flood plains, Flood damage, Peak discharge, Hydrologic data.
Identifiers: *Amesville (Ohio).

Data are presented for use in evaluating the extent and depth of flooding that can be expected along Federal Creek, McDougal Branch, Sharps Fork, and Linscott Run, Amesville, Ohio. Flood frequencies are shown by graphs. Flood profiles showing flood heights are constructed from data obtained from crest-stage stations and flood marks. (Knapp-USGS)
W69-07735

FLOODS IN WILTON CENTER QUADRANGLE, NORTHEASTERN ILLINOIS,
Geological Survey, Washington, D. C.
Howard E. Allen, and Allen W. Noehre.
Geol Surv Hydrol Invest Atlas HA-304, 1 sheet, 1969. Text, 11 fig, 1 map, 2 tab, 3 ref.

Descriptors: *Floods, *Illinois, *Hydrographs, Stream gages, Stage-discharge relations, Streamflow, Flood plains, Flood damage, Peak discharge, Hydrologic data.
Identifiers: Wilton (Ill).

Floods in the Wilton Center quadrangle, northeastern Illinois, are described in a 1-sheet hydrological atlas consisting of maps, charts, tables, diagrams, profiles, and graphs. Flooded areas, locations of gages, and location are shown by maps. Flood frequencies are shown by graphs. The hydrological data may be used to evaluate depth, extent, and frequencies of floods that affect the development of flood plains in the area. (Knapp-USGS)
W69-07736

FLOODS ON LITTLE BUFFALO CREEK AT WEST JEFFERSON, NORTH CAROLINA,
Geological Survey, Washington, D. C.
William J. Haire.
Geol Surv Hydrol Invest Atlas HA-331, 1 sheet, 1969. Text, 4 fig, 1 map, 2 tab, 2 ref.

Descriptors: *Floods, *North Carolina, *Stage-discharge relations, Discharge (Water), Streamflow, Hydrographs, Flood plains, Flood damage, Peak discharge, Hydrologic data.
Identifiers: *West Jefferson (NC).

Data are presented for use in evaluating the extent and depth of flooding that can be expected on Little Buffalo Creek near West Jefferson, North Carolina. Flooded areas are shown on an air photograph scaled about 1 inch to 500 ft. Flood frequencies are shown by graphs. Flood profiles showing flood heights are constructed from data obtained from crest-stage stations and flood marks. (Knapp-USGS)
W69-07737

SIMULTANEOUS USE OF AN ANALOG SINGLE-PURPOSE ELECTRONIC COMPUTER AND A PHYSICAL MODEL O WATERSHED,
Prague Agricultural Univ. (Czechoslovakia) of Water Resources.
For primary bibliographic entry see Field 02
W69-07743

WATERSHED SIMULATION BY ELECTR ANALOG COMPUTER,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 02
W69-07744

APPLICATION OF AN ELECTRONIC AN COMPUTER TO A STUDY OF W RESOURCES MANAGEMENT,
Utah Water Research Lab., Logan; and Uta Univ., Logan. Dept. of Civil Engineering.
For primary bibliographic entry see Field 06
W69-07745

APPLICATION OF ANALOGUE COMPU FOR PREDICTING THE GROUND W REGIME OF ARTESIAN BASINS UNDER DITIONS OF THEIR DEVELOPMENT,
All-Union Research Inst. of Water S Drainage, Hydro-Engineering Works an gineering Hydrogeology, Moscow (USSR).
For primary bibliographic entry see Field 02
W69-07746

FLOW DURATION OF OHIO STREAMS,
Geological Survey, Columbus, Ohio.
William P. Cross.
Ohio State Dept Natur Resources, Div of Bull No 42, 1968. 68 p, 1 plate, 2 tab, 2 ref.

Descriptors: *Streamflow, *Frequency a *Ohio, *Data collections, Discharge (W Hydrologic data, Stream gages, Surface wate ration curves, Depth-area-duration analys noff.
Identifiers: Flow duration.

Flow durations of Ohio streams are comput presented in tables. Records of 164 gaging s for the 10 yr period ending Sept. 30, 1965 an lated. (Knapp-USGS)
W69-07753

PRINCIPAL LAKES OF THE UNITED STA
Geological Survey, Washington, D. C.
Conrad D. Bue.
Geol Surv Circ No 476, 1963. 22 p, 5 fig, 6 t ref.

Descriptors: *Lakes, *Fresh water, *Bib phies, *United States, Recreation, Great L Lake morphology, Geologic control, Glac Depth, Saline lakes.
Identifiers: *Natural lakes, *Glossary.

To fill a need for general information on lak the nontechnical reader, this report presents a glossary of United States lakes that have s areas of 10 sq mi or more. Of the approxi 250 fresh-water lakes in this size range, 100 Alaska and 100 are in Minnesota, Wisc Michigan, New York and Maine. Excludi Great Lakes, 34 of the fresh-water lakes have imum depths of 250 ft or more, of which known to be in Alaska. Since many lakes in A have not been sounded, other lakes doubtle be found to be more than 250 ft deep. The stored in natural lakes--exclusive of the Lakes--is much greater in amount than that in all artificial reservoirs, but in economic val man-made reservoirs are more valuable. N lakes are best known for their recreation vantages. (Lang-USGS)
W69-07770

T SIMULATION: A DYNAMIC APPROACH THE PERT TECHNIQUE,
on State Univ., Corvallis; and Foamat Foods ., Corvallis, Oreg.
ord F. Gray, and Robert E. Reiman.
t Manage, Vol 20, No 3, pp 18-23, Mar 1969. 6 fig, 2 tab, 7 ref.

riptors: *PERT, Project planning, Programs, nning, Estimating, Time, Probability, Manage-, Simulation, Monte Carlo method, Decision ng, Models, Design tools, *Critical path od, *Scheduling, Operations research, Com-rs.
ifiers: Network analysis.

T Simulation is a new technique for coping uncertainty and instability of time estimates in early stages of project management. Large plex PERT networks with several closely timed al paths have a high probability that the actual al path may shift several times during the se of project work. Standard PERT analyses ased upon estimates of mean activity duration s and give little information on what happens if activity time varies. PERT Simulation incor-tes the variance or uncertainty of actual dura-time into the analysis by a probability distribu-for duration time. The likelihood of critical shifting is evaluated by determining the rela-probabilities of each network activity and of alternative path becoming critical. The trans-ation of the standard PERT model to PERT lation is described; some key points are noted etwork analysis under this system. Two exam-of applications are given. Advantages and observations regarding the use of PERT lation are listed. (USBR)
-07775

OF ANALOG COMPUTERS FOR SIMU-ING THE MOVEMENT OF ISOTOPES IN LOGICAL SYSTEMS,
derbilt Univ., Nashville, Tenn. Graduate ol.
primary bibliographic entry see Field 05B.
-07819

MPUTER APPLICATIONS IN HYDROLOGY ANSAS,
ogical Survey, Lawrence, Kans.
les O. Morgan, Jesse M. McNellis, and Brent owell.
State Geol Surv Bull 194, Part 1, Short Pap on in 1968, pp 3-7, Feb 1969. 5 p, 5 fig, 2 tab, 11

riptors: *Hydrologic data, *Data collections, ta processing, *Data storage and retrieval, nsas, Digital computers, Computer programs, ping, Contours, Water quality, Water wells, fers, Water levels.
tifiers: U. S. Geological Survey (Kans Dist).

Kansas District of the Water Resources Divi-, U.S. Geological Survey, in cooperation with State Geological Survey of Kansas, has been olishing a data-processing system, including age and retrieval, for hydrologic data since 3. The data bank developed contains thousands ell-inventory, water-quality, water-level, and logic-log records. Accuracy of data in the bank sured through a system that begins with coded s, includes computer programs that check for errors, and ends with manual proofing of puter output. Numerous computer programs manipulate and analyze data from the bank been written, and these programs have nced the interpretive capability of a hydrolo-Methods of examining data that were not prac-le before the advent of the computer are now ble. Use of the computer has encouraged lopment of new analytical techniques and the tation of methods from other scientific fields ne interpretation of hydrologic data. Utilizing a speed digital computer, the Kansas District lo specific tasks, achieving higher interpretive quality in less time and at a lower cost than was possible previously. (Knapp-USGS)
W69-07930

APPLICATION OF AN ELECTRONIC ANALOG COMPUTER TO THE EVALUATION ON THE EFFECTS OF URBANIZATION OF THE RUNOFF CHARACTERISTICS OF SMALL WATERSHEDS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 04C.
W69-07951

SPECIALIZED ANALOG COMPUTERS FOR HYDROLOGICAL CALCULATIONS AND FORECASTS,
Hydrometeorological Centre, Moscow (USSR).
A. G. Levin.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Int Ass Sci Hydrol, Pub No 80, Vol 1, pp 67-72, 1968. 6 p, 5 fig, 3 ref.

Descriptors: *Analog computers, *Streamflow forecasting, Flood forecasting, Runoff forecasting, Weather forecasting, Forecasting, Routing, Warning systems.
Identifiers: *USSR, Rainfall forecasting, Rain-flood forecasting.

The analog computer used for hydrologic forecasts in the USSR is described. Its capabilities include forecasts of rainfall, rainfall floods, hydrograph analysis and routing. (Knapp-USGS)
W69-07952

THE SOLUTION OF DIRECT AND INVERSE PROBLEMS OF OUTLET WAVES SPREADING ON ANALOG COMPUTERS,
Ministry of Reclamation and Water Economy, Erevan (USSR). Water Problems and Hydrotechnics Research Inst.
K. Kh. Hovsepian, R. S. Avetisian, and A. G. Nazarian.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Int Ass Sci Hydrol, Pub No 80, Vol 1, pp 73-80, 1968. 8 p, 6 fig, 6 ref.

Descriptors: *Analog computers, *Open channel flow, *Routing, Hydraulics, Canals, Irrigation water, Discharge (Water).
Identifiers: *USSR, St. Venant's equation.

An analog computer is used in the USSR to solve canal inflow-outflow wave relationships, using St. Venant's equation. Comparison of observed and computed hydrographs shows the good accuracy of the method. (Knapp-USGS)
W69-07953

THE MAR ANALOG COMPUTER FOR MODELLING HYDROLOGICAL SERIES BY THE MONTE CARLO METHOD,
For primary bibliographic entry see Field 02A.
W69-07954

ESTIMATION OF FLOODS WITH THE AID OF ANALOGUE COMPUTERS,
Gidrometeorologicheskii Institut, Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W69-07955

NEW APPROACH SUGGESTED FOR DESIGN OF ELECTRICAL ANALOG COMPUTERS FOR GROUNDWATER FLOW STUDIES,
Tata Inst. of Fundamental Research, Bombay (India).
For primary bibliographic entry see Field 02F.
W69-07956

UTILIZATION OF THE ANALOG COMPUTER FOR SIMULATING THE SALINITY FLOW SYSTEM OF THE UPPER COLORADO RIVER BASIN,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 02E.
W69-07957

DIGITAL COMPUTER SOLUTIONS FOR FLOOD HYDROGRAPH PREDICTION FROM RAINFALL DATA,
Technische Hochschule, Munich (West Germany).
Hydraulics Research Station Obernach.
For primary bibliographic entry see Field 02A.
W69-07958

DETERMINATION OF THE RUNOFF HYDROGRAPH ON A DETERMINISTIC BASIS USING A DIGITAL COMPUTER,
Technical Univ. of Budapest (Hungary).
For primary bibliographic entry see Field 02A.
W69-07959

DETERMINATION OF THE QUANTITY OF WATER TO BE STORED BY DIGITAL COMPUTERS,
Institute of Research of the Hydraulic Resources, Budapest (Hungary).
For primary bibliographic entry see Field 04A.
W69-07960

HYDROGEOLOGIC DATA FROM CHEYENNE, DECATUR, RAWLINS, SHERIDAN, SHEMAN, AND THOMAS COUNTIES, KANSAS,
Kansas State Geological Survey, Lawrence; and Geological Survey, Lawrence, Kans.
Katherine M. Keene, Richard H. Pearl, and Marilyn E. Pabst.
Kans Ground Water Basic Data Release No 1, 1969. 113 p, 1 fig, 1 plate, 5 tab.

Descriptors: *Data collections, *Hydrologic data, *Water wells, *Kansas, Aquifers, Water quality, Water levels, Observation wells, Water-level fluctuations, Groundwater.
Identifiers: Cheyenne County, Decatur County, Rawlins County, Sheridan County, Sherman County, Thomas County (Kans), Periodic observations.

Groundwater basic data are compiled for the 6 northwestern counties of Kansas. Records of 1,685 wells are tabulated. Observation well records show seasonal water-level fluctuations for periods as long as 26 yr. Chemical analyses are tabulated for 351 representative wells. Lithologic logs of 334 test holes are included. The Ogallala formation and alluvial deposits yield moderate to large amounts of water to wells. Other aquifers are less productive. (Knapp-USGS)
W69-08018

FUNCTION SPACE APPROACH TO PARAMETER IDENTIFICATION IN DISTRIBUTED SYSTEMS,
Hitachi Research Lab., Ibaraki (Japan); and California Univ., Los Angeles.
For primary bibliographic entry see Field 02A.
W69-08023

MATHEMATICAL SIMULATION OF WATER MOVEMENT THROUGH UNSATURATED NONHOMOGENEOUS SOILS,
Harvard Univ., Cambridge, Mass. Dept. of Water Resources.
For primary bibliographic entry see Field 02G.
W69-08026

BASIC DATA FOR URBAN HYDROLOGY STUDY, DALLAS, TEXAS--1966,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 02E.
W69-08056

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08. ENGINEERING WORKS

8A. Structures

RIVER DIVERSION FOR BOUNDARY DAM,
Bechtel Corp., San Francisco, Calif.
Adolf A. Schilling.
Prepr 787, Amer Soc Civ Eng Annu Meet Nat Meet Water Resour Eng, New Orleans, La, Feb 1969. 25 p, 12 fig.

Descriptors: *Diversion, *Diversion structures, *Diversion tunnels, Diversion works, Diversion dams, Cofferdams, Arch dams, Tunnel linings, Underground powerplants, Tunnel plugs, *Tunnels, Intake structures, River closures, Gunite, Blasts, Construction.
Identifiers: *Overtopping, Boundary Dam (Wash), Blasting.

Diverting the Pend Oreille River at Boundary Arch damsite, Wash, was accomplished by constructing 2 rockfill cofferdams and a 42-ft horseshoe tunnel in the left abutment. Although this scheme followed generally accepted practice, several unique features were incorporated in the design and construction. Tunnel excavation was performed from the inside of the arch dam abutment via an adit from the underground powerplant, leaving a rock plug at each tunnel portal. Opening the portals and rerouting the river was accomplished by a series of singular rock blasts. The tunnel floor was left unlined; gunite was applied to the side walls and roof to improve hydraulic performance. The capacity of the diversion scheme was limited to river discharges during the low flow periods; flood flows were discharged over the partly completed arch dam. The diversion tunnel was closed by lowering a counterbalanced, arched, steel gate into the flow at the tunnel during diversion; a second plug sealed the diversion tunnel after closure. (USBR)
W69-07784

DIVERSION WORKS, SNETTISHAM PROJECT,
Corps of Engineers, Anchorage, Alaska.
Thomas E. Munsey.
Prepr 824, Amer Soc Civ Eng Annu Meet Nat Meet Water Resour Eng, New Orleans, La, Feb 1969. 17 p, 8 fig, 5 ref.

Descriptors: *Diversion works, *Diversion, *Diversion tunnels, Lakes, Alaska, Outlet works, Outlets, Hydroelectric power, Underwater construction, Underwater television, Core drilling, Tunnels, *Tunnel construction, Instrumentation, Tunneling, Joints (Geology).
Identifiers: Outlet tunnels, Underwater explosions, *Rock traps, Underwater photography, Snettisham Proj (Alaska).

The Norwegian method of lake piercing is being used to temporarily lower the water surface of a southeastern Alaska lake 130 ft below its natural level. After the surface drops, a power intake works will be constructed just above the low-water level, making available for hydropower development 110,000 acre-ft of natural storage which would have been lost had a more conventional means of diversion been used. Preliminary exploration included core borings, soundings, and examination with an underwater TV camera. Design and final profile of the tap, rock trap, and outlet tunnel are described. To illustrate typical problems in lake piercing, an account of the excavation of the most critical portion (the last 100 ft of the tunnel and rock trap) is given. Alterations in the tapping setup and procedure are the rule rather than the exception during construction. (USBR)
W69-07787

FACTORS OF SAFETY IN THE DESIGN OF BURIED PIPELINES,
Iowa State Univ. of Science and Technology, Ames.
M. G. Spangler.
Prepr ERI 359, Annu Meet Highw Res Bd, Nat Res Counc, Jan 1969. 17 p, 6 ref.

Descriptors: *Safety factors, *Safety, *Pipelines, Pipes, Design, Soil pressure, Pressure distribution, Lateral forces, Ultimate loads, Bending moments, *Concrete pipes, *Steel pipes, Loads (Forces), Shear strength, Shear stress, Structural design, Reinforced concrete, Culverts.
Identifiers: Pipe bedding, Pipe cover, Pipe cradles, Flexible pipes, Pipe laying, *Pipe design, Soil-structure interaction, Ultimate strength.

Factor of safety may be broadly defined as the ratio of the maximum load that a structure is capable of supporting to the load that the structure is designed to carry. This ratio may be determined and expressed in many ways. A factor of safety of unity is recommended as being adequate and economical for reinforced concrete pipe installations designed on the basis of the minimum 0.01 in. crack 3-edge bearing test strength of the pipe. When designing on the basis of the ultimate test strength, a factor of safety of 1.5 should be used. For nonreinforced rigid pipes, a factor of safety of 1.5, based upon the minimum ultimate test strength, is recommended for general design application, with possible reduction to 1.4 or 1.3 in unusually favorable circumstances. A limiting deflection of 5% of initial diameter is recommended for flexible metal pipe installations. This is approximately one-fourth (factor of safety of 4) of a critical deflection of 20%. The design of longitudinal bolted seams in flexible metal pipes should be based upon the ability of the seam to carry a composite of shear and bending moment stresses and not on shear strength alone. (USBR)
W69-07792

HYDRAULIC DESIGN OF LARGE SURGE TANKS FOR PUMPING PLANTS,
California State Dept. of Water Resources, Sacramento.
Ravinder K. Jain, Roy T. Nakahara, and John W. White.
Tech Memo No 38, Dept Water Resour, Calif, Nov 1968. 30 p, 9 fig, 1 tab, 5 ref.

Descriptors: *Surge tanks, Water hammer, *Hydraulic design, Pressure, Transients, Discharge lines, Energy losses, Graphical analysis, Surges, Hydraulic structures, Pumping plants, Orifices, Analysis.
Identifiers: Tehachapi Pump Plant (Calif), *Pressure waves, *Water column separation.

The hydraulic design of large surge tanks is described, placing emphasis on designs used for the Tehachapi surge tank. Graphical and analytical methods for determining the size of large surge tanks for pumping plants are given. Energy loss coefficients for different orifice configurations tested are included. Surge tanks are used to control transient pressures and to prevent water column separation. Flow in discharge lines communications with the surge tank through orifices connecting discharge lines with the tank. Normal operationproduces changes in flow rates in discharge lines, resulting in positive or negative transient pressure waves reflected at the surge tank as minor fluctuations in water surface elevation protecting discharge lines and downstream tunnels from these surges. During emergency conditions all pumps could be shut down at once by a power failure. This condition causes the pumps to halt, changing rotational direction as soon as water begins to flow back. The reverse flow continues until the downstream valves are closed. To prevent low pressures in discharge lines or water column separation under this condition, water is supplied from the surge tank. (USBR)
W69-07802

TOWARD THE IMPROVEMENT OF THE CONSTRUCTION WORK FOR HYDROELECTRIC POWER PLANTS,
V. L. Kuperman.
Hydrotech Constr, No 8, pp 671-677, Aug 1968. 7 p, 3 fig, 15 ref.

Descriptors: *Construction, *Hydroelectric po
Concrete dams, Cold weather construction, Di
sion tunnels, River closures, Cofferdams, Fl
routing, Underground structures, *Foreign
struction, Tunneling, Underground powerpla
Tunnel linings, Hydraulic structures, Grou
Construction costs, Bibliographies.
Identifiers: *Construction methods, *US
Siberia, Hydroelectric resources, Blasting.

Hydroelectric power construction in the USS
moving from the European plains of the USS
the high mountainous regions of Asia and
Siberian rivers. Many innovations in materials
methods are required since the new constructi
(1) on rivers having large flows with frequent
tuations, (2) at sites requiring large concrete d
and (3) in areas having very severe weather
temperature conditions. New problems pertai
to construction work for power projects incl
(1) river diversion, (2) methods of storage du
diversion, (3) use of local materials for dams,
rock work and special equipment required,
earth and concrete work where temperatures
reach 50 deg C below zero, (6) underground
struction, and (7) special grouting methods
strengthening existing foundation mate
(USBR)
W69-07809

ROADS AND HIGHWAYS.
For primary bibliographic entry see Field 06E.
W69-07889

ROADS AND HIGHWAYS.
For primary bibliographic entry see Field 06E.
W69-07890

ROADS AND HIGHWAYS.
For primary bibliographic entry see Field 06E.
W69-07891

ROADS AND HIGHWAYS.
For primary bibliographic entry see Field 06E.
W69-07892

**PROBLEMS OF STORAGE DAM CONSTR
TION IN EASTERN HERZEGOVINA (FRENC**
Stjepan Mikulec.
Hydrol of Fractured Rocks Vol 2, Proc Dubro
Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74
590-598, 1967. 9 p, 3 fig, 4 ref.

Descriptors: *Dam construction, *K
*Hydrologic properties, *Engineering geol
Fractures (Geology), Tracers, Water stor
Economics, Rivers, Geophysics, Hydrogeology
rigation, Hydroelectric power, Sea l
Geochemistry, Sodium, Fluorescence, Permea
ty.
Identifiers: *Yugoslavia, Eastern Herzegov
Trebisnjica River.

Geologic, hydrologic, and economic condit
present in eastern Herzegovina, Yugoslavia,
investigated for the purpose of efficient const
tion of three dams. One of the dams located on
Trebisnjica river is under construction. Becau
large part of the eastern Herzegovian is hi
karstified test borings totaling over 10,000 m
made, and sodium-fluorescine tracer techni
were employed to study underground water m
ment. Underground water channel systems
also investigated by blocking an intermit
stream and some underground channels. It is
sumed that the work planned will permit an ov
output of 3.5x10 to the 9th power kilowatt hou
electric energy at a cost not exceeding the co
constructing a power station under normal co
tions. (Gabriel-USGS)
W69-07984

OCHASTIC MODEL FOR THE RESPONSE PERMANENT OFFSHORE STRUCTURES ECT TO SOIL RESTRAINTS AND WAVE CES,
gia Inst. of Tech., Atlanta. School of Civil En-ring.
L. Edge, and Paul G. Mayer.
gia Tech Inst Tech Water Resources Center VRC-0269, Apr 1969. 203 p, 35 fig, 7 tab, 87 append.

riptors: *Structures, *Offshore platforms, es (Water), *Statistical models, Coastal ures, Hydraulics, Mathematical models, puter programs, Stochastic processes, etic hydrology.
fiers: *Wave forces.

thematical model is developed to determine ave response of permanent offshore struc- which are embedded in the ocean floor and are subject to harmonic or random waves. sual assumptions of a rigid foundation is not , but the resistance of the soil to structural ments is included in the model. The type of ures for which this model is applicable are, in al, space-frames. A continuous structural l should give more information than the d-mass model for a given computational ef- Each component of the structure is considered a free-free element and geometrical con- ts tie the free-free elements into a structural n. The set of equations is then transformed to f independent equations in the normal coor- es of the structure. The effect of the soil medi- n the structure is represented by means of a er foundation. The hydrodynamic forces on ructure are obtained from the Morison force ion. The wave forces are considered for both armonic and random case. An example is of the application of the model to a realistic ure. The example structure has 4 legs which rate the soil, 2 tiers of horizontal bracing, and l platform above the water surface. The physi- arameters are varied to indicate the relative tance of these variables. (Knapp-USGS) 08008

LYSIS OF SMALL WATER MANAGE- T STRUCTURES IN IRRIGATION DIS- UTION SYSTEMS,
rimary bibliographic entry see Field 04A. 08117

Hydraulics

THE HIGH REYNOLDS NUMBER FLOW R A WAVY BOUNDARY,
rnia Univ., San Diego, La Jolla. Inst. of hysics and Planetary Physics.
rimary bibliographic entry see Field 02E. 07705

TROL OF TRANSIENT FREE-SURFACE W,
gan Univ., Ann Arbor.
Wylie.
Amer Soc Civ Eng, J Hydraul Div, Vol 95, No pp 347-361, Jan 1969. 15 p, 13 fig, 9 ref, 3 nd.

riptors: *Unsteady flow, Open channel flow, ol, Operation and maintenance, Control ures, Control systems, Gates, Canals, Theory, ulic gates, *Flow control, Steady flow, Nu- al method, Computer programming, Irriga- peration and maintenance, Power operation maintenance, Hydraulics, Free surfaces, raulic transients.
ifiers: *Transient flow, Control equipment.

oncept of controlled flow in open channels is luced. A method of analysis is presented, ing the motion of valves or gates to be ied so that the unsteady flow in the period en initiation of the first control movement and the final movement is determined completely. When final control motion ceases, the flow is steady along the entire channel length. Theory is presented and examples are given showing application of the concepts to specific problems. Restrictions on the method and assumptions in the theory are discussed. The standard characteristics method of analysis provides a check on the gate stroking theory for specific problems. Controlled free-surface flow provides design procedures for the theoretical determination of gate or valve movements to control unsteady open-channel flow. If an on-line computer is used in a canal system, input data regarding the instantaneous conditions in the channel, together with input or stored data pertaining to normal operational methods and responses to emergency conditions, can be analyzed in a few seconds. Computed results are then available for real-time computer control. (USBR)
W69-07797

FLUVIATILE OBSTACLE MARKS FROM THE WADIS OF THE NEGEV (SOUTHERN ISRAEL),
Geological Survey of Israel (Jerusalem).
For primary bibliographic entry see Field 02J.
W69-07944

THE SOLUTION OF DIRECT AND INVERSE PROBLEMS OF OUTLET WAVES SPREADING ON ANALOG COMPUTERS,
Ministry of Reclamation and Water Economy, Erevan (USSR). Water Problems and Hydrotechnics Research Inst.
For primary bibliographic entry see Field 07C.
W69-07953

SPATIAL VARIATION OF FLOOD FREQUENCIES AS RELATED TO HYDRAULIC GEOMETRY,
Georgia Univ., Athens. Dept. of Geography.
For primary bibliographic entry see Field 02E.
W69-07991

A STOCHASTIC MODEL FOR THE RESPONSE OF PERMANENT OFFSHORE STRUCTURES SUBJECT TO SOIL RESTRAINTS AND WAVE FORCES,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
For primary bibliographic entry see Field 08A.
W69-08008

A NUMERICAL MODEL FOR THE SIMULATION OF TIDAL HYDRODYNAMICS IN SHALLOW IRREGULAR ESTUARIES,
Texas Univ., Austin. Hydraulic Engineering Lab.
For primary bibliographic entry see Field 02L.
W69-08112

8C. Hydraulic Machinery

LABORATORY TESTS OF A MAGNETIC FLOWMETER,
Vevey Engineering Works Ltd. (Switzerland).
J. Chappuis, and J. C. Chavan.
Water Power, Vol 21, No 2, pp 60-64, Feb 1969. 5 p, 5 fig, 1 tab, 9 ref.

Descriptors: *Flow measurement, *Flowmeters, *Flow rates, Fluid flow, *Water measurement, Measuring instruments, Instrumentation, Hydraulic equipment, Hydraulic laboratories, Laboratory equipment, Laboratory tests, Hydraulic machinery, *Velocity meters.
Identifiers: *Magnetic flow meters, Foreign testing, Switzerland.

A magnetic flowmeter was tested for use in a hydraulic machinery laboratory. The test program included: (1) determining the discharge coefficient under various flow rates, (2) calculating the mean deviation of repeated measurements, (3) observing instrumental drift, (4) noting effects of external environmental conditions on measurements such as temperature and electrical fields, and (5) checking the stability of the supply circuit. The flowmeter was calibrated in the laboratory with a volumetric tank and a switching valve. Tests showed consistency of the discharge coefficient and a mean deviation of plus or minus 0.35%. No drift of the value of the discharge coefficient with time was observed; the absolute value of the coefficient agreed within 0.08% of the coefficient calculated by the indirect method. The magnetic flowmeter can be used successfully in a hydraulic machinery laboratory. (USBR)
W69-07781

PLANNING AND SIZING OF THE GRAND COULEE THIRD POWERPLANT,
Bureau of Reclamation, Boise, Idaho.
Harold T. Nelson.
Pap, Amer Soc Civ Eng Water Resour Eng Meet, Power Div, New Orleans, La, Feb 1969. 36 p, 14 plate.

Descriptors: *Hydroelectric plants, Hydroelectric power, *Planning, Electric generators, Grand Coulee Dam, *Electric power, Washington, Columbia River, Electric power costs, Electric power demand, Peaking capacities, Economics, Optimum development plans, Benefits, Aesthetics, Construction costs, Architecture.
Identifiers: *Grand Coulee Powerplant (Wash), Columbia Basin Project (Wash).

Significant evolutionary planning steps leading to the selection of total plant capacity and size of units for the Third Powerplant, Grand Coulee Dam, Wash, are discussed. These planning steps cover a time span from 1951 through 1968, wherein sizes of units examined were from 108 mw (as rewound to 125 mw), 300 mw, and 600 mw, with corresponding Third Powerplant capacities ranging from 1000 to 7200 mw. The result is an on-going construction program calling for the necessary modifications to the existing structure, and the design, construction, and installation of a first stage of six 600-mw units, followed by a second stage of 6 additional 600-mw units. The plan calls for rewinding existing units and future installation of 6 pump turbines having a possible total installed at-site capacity of 9771 mw by 1992. The background of certain factors influencing the selection of the size of plants and units in the existing installation is presented, which, when combined with very important recent-year hydrologic, political, and technical developments in the power generation and transmission fields, led to the establishment of the Third Powerplant program. (USBR)
W69-07788

DIGITAL COMPUTERS FOR HYDROELECTRIC POWER STATIONS,
Brown, Boveri and Co. Ltd., Baden (Switzerland).
A. Blum, and F. Frischenschlager.
Brown Boveri Rev, Vol 55, No 9, pp 553-559, Sept 1968. 7 p, 1 fig, 1 tab, 4 ref.

Descriptors: *Digital computers, *Hydroelectric plants, *Automatic control, Hydroelectric power, Data processing, Networks, Electronic equipment, Data transmission, Pumped storage, Reservoir operation, Foreign research, Water management (Applied), Faults (Electrical).
Identifiers: *Interconnected systems, Switzerland, Telecommunication systems.

As the use of automatic control becomes more widespread and interconnected groups of power stations and distribution networks become more extensive, the need for measuring and regulating equipment becomes progressively greater. Central digital computers are required for collecting data and measurements and, depending on the degree of automation, intervening in the control processes. All steps taken toward applying automatic control more extensively in power supply systems are aimed at improving cost effectiveness and reliability of ever larger and more complex installations

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and relieving qualified staff from monotonous jobs. In the event of faults, the limited capabilities of a human operator can have serious consequences in a large installation if no suitable automatic control system is available to initiate the necessary measures quickly enough to protect the plant. Functions of data processing systems in the automatic operation of hydroelectric powerplants are discussed. (USBR)
W69-07803

EHV PIPE-TYPE CABLE INSULATED WITH SF6 GAS,
Central Research Inst. of Electric Power Industry, Tokyo (Japan).
S. Fukuda, H. Okamoto, and T. Udo.
Conf, Progr Overhead Lines Cables 220 kv Above, Inst Elec Eng, London, Great Britain, pp 338-344, Sept 1968. 7 p, 2 fig, 2 tab.

Descriptors: Extra high voltage, *Electric cables, *Experimental data, Heat transfer, *Electric insulation, Electric currents, Gases, Epoxy, Resins, Dielectrics, Electric potential, Foreign research, Steel pipes, Stainless steel, Aluminum, *Conductors, Electric arcs, Electrical properties.
Identifiers: *Pipe-type cables, *Sulfur fluorides, Test results, Japan, Dielectric properties, Experimental design, Gas-pressure cables.

Tests made on 3 sets of experimental pipe-type cables insulated with SF6 gas are described and results given. The cable sets were designed as single-core transmission circuits capable of carrying 2500 mva at 275 kv and 5000 amp. One set, a single-phase cable with a steel conductor in a steel pipe, was given voltage withstand tests only. The other 2 sets were 3-phase cables, one using aluminum conductors in aluminum pipes and the other using aluminum conductors in stainless steel pipes. All 3 sets were insulated with SF6 gas at a pressure of 5 kg/sq cm and had epoxy resin or porcelain annular (doughnut shaped) solid spacers for centering the conductor within the metallic outer pipe. Design data for each test cable are tabulated. Questions not resolved by these tests are: (1) heat transfer characteristics when installed underground, and (2) thermal expansion of cable and counter-measures against earthquakes. (USBR)
W69-07804

OVERHEAD LINE INSULATORS FOR IMPROVED RADIO INTERFERENCE PERFORMANCE,
Steatite and Porcelain Products Ltd., Stourport-on-Severn (England).
C. H. W. Clark.
Conf, Progr Overhead Lines Cables 220 kv Above, Inst Elec Eng, pp 17-22, London, Great Britain, Sept 1968. 6 p, 4 fig, 1 tab, 5 ref.

Descriptors: *Electrical insulators, Electrodes, *Radio interference, *Transmission lines, Electrical coronas, Characteristics, Contamination, Electric currents, Measuring instruments, Foreign research, Performance, Electric potential, Semiconductors.
Identifiers: *Electric discharges, Great Britain, Flashover.

Radio interference (RI) from overhead lines comes from many sources; RI attributed to insulators is discussed. The RI generation is caused by: (1) corona from sharp metal parts of insulators; (2) faulty contact of the ball and socket joints between insulator units, causing small spark discharges; (3) surface discharges on dry insulators; and (4) surface discharges on wet polluted insulators. Methods of measuring RI of insulators under high-voltage stresses are considered. General principles used in designing improved insulators are given. Curves showing typical characteristics of clean insulators of several types are included, illustrating improvements that can be achieved by proper design. The effect of insulator pollution is considered. Stabilizing insulators by using a semiconducting glaze is an effective means of reducing flashover and RI level on insulators under high alternating-current stress. (USBR)
W69-07805

THE DETERMINATION OF EHV CLEARANCES USING PROBABILITY CONCEPTS,
Ente Nazionale per l'Energia Elettrica, Rome (Italy).
L. Paris.
Conf, Progr Overhead Lines Cables 220 kv Above, Inst Elec Eng, pp 107-113, London, Great Britain, Sept 1968. 7 p, 5 fig, 5 ref.

Descriptors: *Transmission lines, *Clearances, *Probability, *Electric insulation, *Extra high voltage, Safety, Electric potential, Conductors, Meteorological data, Winds, Temperature, Foreign research, Sagging, Ice, Errors, Costs, Transmission towers, Electric cables.
Identifiers: *Flashover, *Overvoltage, Electric discharges, Electric conductors, Italy.

Clearances between transmission line conductors and grounded parts that are typical examples of variable geometry insulation are discussed. Clearances vary as a function of conductor mobility because of temperature, wind, ice, and vehicular traffic where transmission lines cross roads. Conventional design of clearances assumes that the conductor takes on a limit configuration from which safety clearances are established. Selecting limit configurations generally assumes some degree of arbitrariness not acceptable for ehv lines because of the relationship of insulation to costs. This condition can be eliminated either by probabilistic methods or conventional methods deriving rational safety clearances and limit configurations on a probabilistic basis. The probability method for designing variable geometry insulations for transmission lines is presented. Statistics of meteorological conditions, design and erection errors, and electric loads permit eliminating arbitrariness of current methods. Applying the probabilistic method to individual insulation is painstaking, but using the method for several typical installations creates the possibility of establishing design rules that will provide desired safety levels. (USBR)
W69-07806

THE INFLUENCE OF SNOW AND ICE DEPOSITS ON SUPERTENSION TRANSMISSION LINE INSULATOR STRINGS WITH SPECIAL REFERENCE TO HIGH ALTITUDE OPERATION,
North-Eastern Swiss Power Co., Baden (Switzerland).
A. Meier, and W. M. Niggli.
Conf, Progr Overhead Lines Cables 220 kv Above, Inst Elec Eng, pp 386-395, London, Great Britain, Sept 1968. 10 p, 5 fig.

Descriptors: *Extra high voltage, *Electrical insulators, Ice, Snow, Field investigations, *Disturbances, *Transmission lines, Temperature, Laboratory tests, Foreign research, Storms, Electric currents, Wind velocity, Electric insulation.
Identifiers: Ice forming, Switzerland, *Icing, *Flashover, Electric discharges, Test results.

During the winter of 1966-67, short-duration disturbances by grounding occurred on a 400-kv transmission line crossing the high mountains of Switzerland. Much of this line was at elevations above 2500 m (approximately 8200 ft), the highest peak being 2750 m (approximately 9000 ft), with extremely severe atmospheric conditions at these elevations. Investigations revealed enormous snow deposits on insulators, forming a snow-ice compound that coated the insulator strings and caused heavy brush discharges. Because of poor accessibility to the line at these disturbance points, laboratory tests were conducted under simulated conditions. Tests were concerned with (1) performance of glaciated insulators, (2) the influences of temperature, and (3) voltage distribution on glaciated, multiple-insulator strings. Several suggested preventive measures tested during the winter 1967-68 showed good results. (USBR)
W69-07807

FLOW DIVIDERS FOR THE MIDD DURANCE (FRENCH),
B.V.S. Co. (France). Research Dept.
L. Levin, and R. Longuemare.
La Houille Blanche, Vol 24, No 1, pp 55-64, 19 10 p, 15 fig, 4 photo, 1 tab, 1 ref.

Descriptors: *Streamflow, *Construction, *Pow plants, Energy conversion, Dams, River basi Canal design, Discharge (Water), High wa mark, Pressure, Model studies, Water supply.
Identifiers: *France, Flow divider design, Dura River.

Because the development of powerplants in middle reaches of the Durance River require careful study of the streamflow apportionment flow-dividing structures were jointly designed the South Alps Laboratory of the 'Electricity France' and B.V.S. Company. This article gives construction details of these 2 structures describes their characteristics pertaining to strea flow apportionment. The main purpose of the fl dividing structures is to apportion rates of fl between the new power stations and the old on The flow dividers are discussed with respect hydraulic and hydromechanical characteristi pressure variations, and dam ratings. (Gabr USGS)
W69-08021

8D. Soil Mechanics

THIRTY YEARS EXPERIENCE WITH FIE INSTRUMENTATION OF EARTH DAMS,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 07B.
W69-07771

BEARING CAPACITY OF PILES,
Technical Bureau for Building and Hydrosta Construction (Germany).
Hanns Simons.
Int Civ Eng, pp 3-9, Jan 1969. 7 p, 8 fig, 1 tab, ref.

Descriptors: Foreign construction, Internal fr tion, Bibliographies, *Pile bearing capacities, P driving, *Pile foundations, *Pile groups, *Pile fr tion, *Pile lateral loads, Piles (Foundations), P spacing, Soil mechanics, Foundations, Skin fr tion, Soil properties, Cohesion, Foreign resear Cohesionless soils.
Identifiers: Pile-driving formulas, *Pile tests.

Four examples show how difficult constructi problems may be solved by using piles. Accordi to German norms, determining the bearing capa ty of piles by either static or dynamic equations not acceptable because the results may differ more than 100%, depending on the equation a coefficient chosen. Experimental and theoreti attempts to evaluate the contribution of point sistance and skin friction to pile bearing capac are discussed. Vertical and horizontal load capac of piles in noncohesive soils can be predicted w an adequate degree of precision by sounding or the Standard Penetration Test. If a pile foundati must be designed without this information, empi cal values given by Schenk (based on numero test loads) should be used. The bearing capacity driven pile groups in loose and medium dense san is generally greater than the sum of the beari capacities of the single piles. At very high densi the bearing capacity of a pile group is less than t sum of the bearing capacities of individual pi because the soil is not consolidated but loosened pile driving. In many cases, the decisive factor designing a pile group is not the bearing capaci but the permissible settlement. (USBR)
W69-07790

FACET METHOD,
ger and Co., Bern (Switzerland).
rimary bibliographic entry see Field 07B.
-07791

CURRENT STATUS OF SOIL DYNAMICS,
achusetts Inst. of Tech., Cambridge.
rt V. Whitman.
Mech Rev, Vol 22, No 1, pp 1-8, Jan 1969. 8
ig, 30 ref.

riptors: *Soil dynamics, Soil engineering,
dations, Cratering, Dynamics, *Earthquake
eering, Earthquakes, Model tests, Vibrations,
s, Stress, Strain, Soil properties, Damping,
ic deformation, Soil mechanics, Liquefaction,
ographies.
ifiers: Dynamic loads, Dynamic response,
mic tests, Blast loads, Soil-structure interac-
Earthquake loads, Wave propagation.

dynamics is divided into 3 branches: machine
dations, protective construction, and
quake engineering. While many principles
methods of analysis are common to the 3
ches, one important difference among them is
nagnitude of the stress and resultant strains.
hine foundations include designing adequate
dations for heavy reciprocating and centrifugal
inery and for impact devices such as drop
s. Designing foundations for precision-
ing radar antennas is an exacting application
s branch. Theoretical methods and model stu-
are used to investigate the effects of nuclear
sions, including cratering, and the design of
tures to resist such effects. These investiga-
have not advanced to the point where accu-
numerical results are possible. The major ob-
e to advance in all aspects of earthquake en-
ering is the scarcity of strong-motion
rdings of actual earthquake ground motions.
ods of predicting and studying ground mo-
resulting from earthquakes are discussed.
R)
-07798

LYSIS OF THE SETTLEMENT OF PILE
UPS,
ey Univ. (Australia).
Poulos.
ech, pp 449-471, Dec 1968. 23 p, 22 fig, 4 tab,
f.

riptors: *Pile groups, *Pile bearing capacities,
driving, *Pile foundations, Pile friction, *Pile
ng, Soil mechanics, Field tests, Foundations,
friction, *Settlement, Load distribution, Dif-
tial settlement, Piles (Foundations), Poisson

ifiers: *Pile caps, Pile tests.

nalysis is made of the settlement interaction
een 2 identical piles in an elastic mass; the in-
e in settlement of each pile caused by interac-
is expressed in terms of an interaction factor,
. In symmetrical pile groups where the piles
equally under equal loads the increase in set-
ent caused by interaction may be obtained by
rposition of the values of alpha for the in-
ual piles in the group. Assuming that super-
ion also holds for any general freestanding pile
p, the behavior of pile groups is analyzed for
ase of a rigid pile cap (equal settlement of all
) and a flexible pile cap (equal load in all
). The influence of pile spacing, pile length,
of group, depth of layer, and Poisson's ratio of
ayer on the settlement behavior of pile groups
amined. Comparisons are made between re-
d observations on the behavior of pile groups
model and field tests and behavior predicted
e theory. In addition to predicting the correct
ds, the theory gives quantitative values that are
easonable agreement with observed values.
R)
-07799

THE SETTLEMENT BEHAVIOUR OF SINGLE AXIALLY LOADED INCOMPRESSIBLE PILES AND PIERS,
Sydney Univ. (Australia).
H. G. Poulos, and E. H. Davis.
Geotech, pp 351-371, Sept 1968. 21 p, 20 fig, 21 ref.

Descriptors: *Pile bearing capacities, *Pile foundations, *Settlement, *Piles (Foundations), Elastic theory, *Axial loads, Bibliographies, Pore pressure, *Stress distribution, Shear stress, Poisson ratio, Cohesive soils, Consolidation, Displacements, Soil mechanics, Foreign research.
Identifiers: Elastic foundations, Australia.

Settlement behavior of a single, axially loaded, incompressible cylindrical pile in an ideal elastic soil mass is analyzed using Mindlin's equation. By considering the pile as a number of uniformly loaded cylindrical elements together with a uniformly loaded circular base, solutions are obtained for the distribution of shear stress along the pile and the displacement of the pile. Influence factors are presented for settlement of a pile in a semi-infinite mass and in a finite layer; effects of length to diameter ratio of the pile, Poisson's ratio of the soil, and soil depth are examined. The major portion of total final settlement of a single pile in an ideal soil occurs as immediate settlement; only a small proportion occurs as time-dependent consolidation settlement. The effect of an enlarged base on the behavior of a single pile is examined and has major significance only for relatively short piles. Some approximate solutions for the settlement rate of a single pile are given. Hydraulic boundary conditions of the pile have a considerable influence on the rate of settlement at early times; the rate of pile settlement is generally slower than that of a surface footing of the same radius. (USBR)
W69-07808

RECENT RESULTS OF AN EXPERIMENTAL INVESTIGATION INTO SOIL PRESSURE ON RIGID WALLS,
P. I. Yakovlev, and R. V. Lubenov.
Hydrotech Constr, No 7, pp 625-629, July 1968. 5 p, 5 fig, 1 tab, 5 ref.

Descriptors: *Soil pressure, Soil engineering, Soil tests, Backfill, Retaining walls, Lateral forces, *Live loads, Pressure gages, Models, *Pressure distribution, Foreign research, Displacements, Model tests, Soil mechanics.
Identifiers: Soil stress gages, Coulomb theory, USSR.

Pressure on retaining walls is not necessarily proportional to the magnitude of variable live loads applied on the surface of the backfill. Backfill pressure was investigated in an experimental trough 109 cm high, 100 cm wide, and 177.5 cm long. Contact pressures and stresses in the backfill were measured with strain gage dynamometers. After completely removing the first uniformly distributed load from the backfill, 56.3% of the pressure increase during load application was retained. Reaction to a second and third loading was considerably different. Considering only the nature of the surface loading of the backfill during calculation and disregarding the previous loadings on the wall can produce results that do not reflect the actual stress. Pressure on the wall, measured during filling of the trough, exceeds the theoretical pressure (according to the Coulomb theory) 1.15 to 1.65 times. Backfill pressure was studied on walls that were allowed controlled displacement. As the wall displaces, pressure on the lower section decreases considerably while pressure on the upper section varies slightly. Increasing the distance of the live load from the wall reduces the lateral pressure near the backfill surface. (USBR)
W69-07811

CLASSIFICATION OF SOILS WITH REFERENCE TO COMPACTION,
Swedish Geotechnical Inst., Stockholm; and Aktiebolaget Vibro-Verken, Solna (Sweden).
Bengt Broms, and Lars Forssblad.
Pap, Swedish Geotech Inst, No 29, Repr Prelim Rep, Stockholm, Sweden, 1968. 10 p, 1 tab, 2 ref.

Descriptors: *Soil classifications, *Soil compaction, *Soil mechanics, Soil density, *Soil groups, Soil moisture, Soil properties, Soils, Shear strength, Soil strength, Soil types, *Compaction, Compaction equipment, Cohesive soils, Cohesionless soils, Gradation, Pneumatic tired rollers, Permeability, Rollers.
Identifiers: Soil characteristics, Vibratory compaction.

A soil classification system with 4 principal groups and subgroups divides soils into groups each requiring the same amount of compactive effect to obtain a specified degree of compaction. The 4 principal groups are: (1) rockfill and granular soils with large stones and boulders; (2) sand and gravel; (3) silt, silty, soils, clayey sand, and clayey gravel; and (4) clay. Groups 2 and 4 have subgroups. Classification in Groups 1, 2, and 3 only requires determining the gradation, but unconfined shear strength or undrained shear strength must be estimated or measured for Group 4 soils. Groups 1 and 2 are noncohesive soils with high permeability. These soils can be compacted at a high water content, have a high bearing capacity when compacted, and are not susceptible to frost action. Groups 3 and 4 are generally well-graded soils with a high content of fines. The degree of compaction depends on optimum water content to obtain maximum density. Methods and equipment that can be used to compact soils in the different groups are discussed. (USBR)
W69-07813

8E. Rock Mechanics and Geology

DIVERSION WORKS, SNETTISHAM PROJECT,
Corps of Engineers, Anchorage, Alaska.
For primary bibliographic entry see Field 08A.
W69-07787

8F. Concrete

INVESTIGATION OF DETERIORATED CONCRETE ARCH DAM,
California Univ., Berkeley; and Pacific Gas and Electric Co., San Francisco, Calif.
David Pirtz, Arthur G. Strassburger, and Richard C. Mielenz.
Prepr 792, Amer Soc Civ Eng Annu Meet Nat Meet Water Resour Eng, New Orleans, La, Feb 1969. 36 p, 7 fig, 1 tab, 9 photo, 5 ref.

Descriptors: *Arch dams, *Concrete dams, *Concrete technology, Dams, Concrete testing, *Deterioration, Core drilling, Alkali-aggregate reaction, Sulfates, Petrographic investigations, Stress analysis, Weathering, Safety, Demolition, California.
Identifiers: Concrete properties, Sulfate attack, Sonic-pulse test, Sonic velocity tests, Soniscopes, Surveys (Data collection).

The Drum Afterbay Dam, Colfax, Calif, was a concrete arch structure built in 1924. By the early 1960's, the concrete had deteriorated to a degree where arresting the destructive processes and repairing the weathered areas would be necessary within a few years. In 1965, repairs were started but suspicions immediately arose that other than normal weathering processes were responsible for some deterioration. An investigative program of concrete coring and, subsequently, sonic testing of the dam and petrographic examination of the concrete ensued. Conclusions were that the concrete was being subjected to 3 destructive processes: (1) alkali silica reactions, (2) sulfate attack, and (3) leaching of soluble substances from the cement paste matrix. These plus other findings from a concurrent stress analysis indicated that the dam had an undesirably low factor of safety. The

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results and the conclusion that the concrete was continuing to deteriorate at a probable high rate led to the final decision to replace the dam. (USBR)
W69-07785

TECHNOLOGY OF MIXING CEMENT-SAND AND SILICATE CONCRETE MIXES IN A CONTINUOUS JET MIXER,
A. R. Mashin.
Hydrotech Constr, No 8, pp 727-731, Aug 1968. 5 p, 3 fig, 4 tab.

Descriptors: *Concrete mixes, Concrete placing, Foreign construction, *Concrete plants, Concretes, *Concrete construction, Coarse aggregates, Concrete technology, Cements, *Mixers, Mixing, Mixes, *Mortar, Sands, Jets.
Identifiers: Continuous mixing, Fluidized-bed coating, Fluidized beds, Jet mixing, USSR.

A continuous jet mixing plant for stiff cement-sand and silicate mixes is described. Materials are mixed in suspension by compressed air, or compressed air and stream, forming a fluidized bed. Fluidized bed mixing intensifies water absorption by cement particles, breaks up weak particles, accelerates chemical reactions, coats sand particles with cement, permits temperature and pressure regulation, and produces high-strength uniform mixtures. The temperature and pressure control permits autoclave treatment of the mix. Jet mixing is cheaper than conventional methods. Concrete mixes are prepared in 2 stages by jet mixing cement and sand, and then mixing gravel in a forced concrete mixer. Two-stage concrete mixing reduces cement consumption by 30% and increases homogeneity of the concrete. Data and properties of sand-cement and concrete mixes are given. (USBR)
W69-07810

8G. Materials

CARBON FIBRES,
W. T. Gunston.
Sci J, Vol 5, No 2, pp 39-49, Feb 1969. 11 p, 10 fig, 7 ref.

Descriptors: *Composite materials, Carbon, *Fibers, *Laminates, Costs, Laminated plastics, Materials, Materials engineering, *Plastics, Resins, Foreign research, Structural members, Manufacturing, Materials forming, Fabrication, Research and development, Chemical engineering, Materials testing.
Identifiers: Foreign products, Great Britain, *Reinforcing materials, *Carbon fibers, *Reinforced plastics.

Carbon fiber composite materials are emerging from laboratory development to commercial production, and are starting a revolution in engineering materials. Carbon fibers are stronger and stiffer than other synthetic or natural materials of the same weight, except for microscopic single crystal whiskers. Composite materials reinforced with carbon fibers can be made as stiff as steel but only one-fifth as heavy. The article reviews the development of carbon fiber production, describes manufacture of carbon fiber composite materials, and evaluates the impact on materials technology. The world's first production item using carbon fiber composite material is a Rolls-Royce turbofan engine. Present applications under investigation include automobile bodies and spacecraft. The future world market should reach the level of thousands of tons per year within the next decade, although the inevitable price advantage of glass fibers will restrict carbon fibers to true engineering structures and other hard-worked parts. (USBR)
W69-07779

8H. Rapid Excavation

THE CURRENT STATUS OF SOIL DYNAMICS,
Massachusetts Inst. of Tech., Cambridge.
For primary bibliographic entry see Field 08D.
W69-07798

09. MANPOWER, GRANTS AND FACILITIES

9C. Research Facilities

DIRECTORY OF THE UNIVERSITY OF WISCONSIN FACULTY AND STAFF ENGAGED IN WATER RESOURCES ACTIVITIES.
Wisconsin Univ., Madison. Water Resources Center.

(Internal publication), Wis Univ, Water Resources Ctr, Madison, 1969. 62 p.

Descriptors: *Administration, *Education, *Manpower, *Research and development, *Water resources, Agriculture, Analytical techniques, Animals, Chemical analyses, Desalination, Drainage, Ecology, Economics, Engineering, Groundwater, Hydraulics, Lakes, Meteorology, Planning, Plants, Recreation, Sedimentation, Soil properties, Waste treatment, Water chemistry, Water distribution (Applied), Water law, Water pollution sources, Water utilization.
Identifiers: *Directory.

This directory lists the names of 193 members of faculty and staff on Madison, Milwaukee, and Green Bay campuses of The University of Wisconsin who are currently engaged in water resources activities. The individual subject's relevance to water resources activities is indicated by either a brief description of his involvement or a listing of his recent pertinent research. Each person's interests are further defined by a profile of as many as eight terms selected by him from Water Resources Thesaurus published by U S Office of Water Resources Research. An index provides all names listed according to 308 such terms. (Eichhorn-Wisc)
W69-07824

9D. Grants, Contracts, and Research Act Allotments

HANDBOOK OF FEDERAL AND STATE PROGRAMS OF FINANCIAL ASSISTANCE FOR WATER DEVELOPMENT.
California Interim Committee on Water, Sacramento.

Porter, Carley V., Chairman. Calif State Legislature Assembly Comm on Water Handbook, 1 edition. 67 p, 2 append.

Descriptors: *Planning, *Water resources deve ment, *California, *Grants, Water Resou Research Act, Research and development, S governments, Governments, Federal governm Conservation, Recreation, Water supply.
Identifiers: Handbook of water developn assistance.

Important Federal and California programs financial assistance for water development a 1968 summarized. A directory of Federal and S offices involved in water development is inclu (Knapp-USGS)
W69-07974

ANNUAL REPORT OF MINNESOTA WA RESOURCES RESEARCH CENTER I FISCAL YEAR ENDING JUNE 30, 1969,
Minnesota Univ., St. Paul.
William C. Walton.
Mimeographed Report, June 1969. 109 p.

Descriptors: *Water resources research, *M nesota Water Resources Research Center, *Fi Year 1969 Annual Report.
The Fiscal Year 1969 budget of Center \$237,000. The Center financed 14 research jects involving 12 faculty members. These rese projects were concerned with: Eutrophicatio Lake Superior, Water Laws in Minnesota, Prim Productivity of Minnesota Lakes, Waters Hydrographs, Water Quality Managem Economics of Water Quality Control, Movemer Water in Soils, Overfertilization of Surface Wa and Irrigation. About 39 students received emp ment through the Center's program. There we new courses in water resources developed an new staff members added to water resources grams. During the academic year 1968-69, t were 20 Seniors, 18 Masters Degree students, 13 Doctoral Degree students enrolled in wate lated fields. About 51 students graduated wi major in water-related fields. Eleven project lated reports were published in Fiscal Year 196
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For primary bibliographic entry see Field 02J.
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For primary bibliographic entry see Field 05G.
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SILICATE REACTIONS--A REVIEW,
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For primary bibliographic entry see Field 02K.
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A Discussion of the Dispersivity Tensor for a Turbulent Uniform Channel Flow	C. Dagan	Hydronautics, Inc.	No. 10, p. 4, W69-0
Calculation of Dispersion Coefficient in Straight Prismatic Streams	C.L. Yen C. Elata	Hydronautics, Inc.	No. 10, p. 4, W69-0
Urban Water Resources Research; Systematic Study and Development of Long-Range Plans, First Year Report, September 1968		American Society of Civil Engineers	No. 9, p. 50, W69-03

* U.S. GOVERNMENT PRINTING OFFICE 1968 O—39

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- NATURE OF WATER
- WATER CYCLE
- WATER SUPPLY AUGMENTATION AND CONSERVATION
- WATER QUANTITY MANAGEMENT AND CONTROL
- WATER QUALITY MANAGEMENT AND PROTECTION
- WATER RESOURCES PLANNING
- RESOURCES DATA
- ENGINEERING WORKS
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- ABSTRACT SOURCES

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 2, NUMBER 20
OCTOBER 15, 1969

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W69-08127 -- W69-08628

Selected Water Resources Abstracts is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the Clearinghouse for Federal Scientific and Technical Information (CFSTI) of the Bureau of Standards, U. S. Department of Commerce. It is available to Federal agencies, contractors, or grantees in water resources upon request to: Manager, Water Resources Scientific Information Center, Office of Water Resources Research, U. S. Department of the Interior, Washington, D. C. 20240. Annual subscription is $22.00 (domestic), $27.50 (foreign), single copy price is $3.00. Certain documents abstracted in this journal can be purchased from the Clearinghouse at the prices indicated in the entry. Prepayment is required.

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

DOWNGRADED AT 3 YEAR INTERVALS
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VOLUME 2, NUMBER 20
OCTOBER 15, 1969

W69-08127 -- W69-08628

f funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.

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- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the FWPCA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

In cooperation with the Federal Water Pollution Control Administration, the following "centers of competence" have been established:

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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01 NATURE OF WATER
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02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Non-Water Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION
Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

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06 WATER RESOURCES PLANNING
Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA
Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS
Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES
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10 SCIENTIFIC AND TECHNICAL INFORMATION
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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

NATURE OF WATER

. Properties

RESPONSE OF WATER TEMPERATURES METEOROLOGICAL CONDITIONS,
derbilt Univ., Nashville, Tenn.; Office of the eon General (Army) (South Vietnam); and s Hopkins Univ., Baltimore, Md.
Edinger, D. W. Duttweiler, and J. C. Geyer.
er Resources Research, Vol 4, No 5, Oct, 3. 7 p, 1 tab, 10 ref. p 1137-1143.

criptors: *Heat transfer, *Mathematical model, at, Thermodynamic behavior, Specific heat, nt heat, Solar radiation, Conduction, Evapora- Vapor pressure, Wind velocity, Air tempera- Atmospheric pressure, Water temperature, point, Time lag, Heat budget, Meteorology, eorological data.
tifiers: *Thermal exchange coefficient, uilibrium temperature, Back radiation, Con- ion, Stefan-Boltzmann law, Atmospheric radia- Reflected radiation.

exchange of heat across the air-water interface e of the more important factors that govern the perature of a water body. The net rate of heat ange at the water surface is the sum of the s at which heat is transferred by radiative esses, by evaporation, and by conduction reen water and overlying air. The net rate can valuated in terms of a thermal exchange coeffi- t and an equilibrium temperature, both of ch depend on observable meteorological varia- Any one of the many evaporation formulas mathematical descriptions of the other heat ange processes may be used to develop equa- s involving the thermal exchange coefficient equilibrium temperature. Such equations are ul in developing relations that describe the poral and spatial temperature distributions in a water body. They provide additional in- t into the effects of meteorological conditions water temperatures, and they facilitate esti- es of various terms of the heat budget. (Motz-derbilt)
9-08417

SERVED DIFFRACTION PATTERN AND POSED MODELS OF LIQUID WATER,
Ridge National Lab., Tenn. Chemistry Div.
I. Narten, and H. A. Levy.
nce, Vol 165, No 3892, pp 447-454, Aug 1969. 3 fig, 38 ref.

criptors: *Water structure, *Hydrogen bond- *X-ray diffraction, Molecular structure, Water perties, Crystallography, Model studies.
tifiers: Water (Liquid structure).

ious structural models proposed to explain the erved X-ray scattering by water are examined. st of the models are incompatible with observed tering or are insufficiently defined at the ecular level for adequate testing. Distorted d models, gas hydrate models, and ice-struc- l models are considered. Only an ice-I model es with calculations of both small and large e X-ray scattering. Conditions which must be by reasonable water-structure models are n. (Knapp-USGS)
9-08560

. WATER CYCLE

. General

OMORPHOLOGY,
delberg Univ. (West Germany); and Univer- et des Saarlandes, Saarbruecken (West Ger- ny).
primary bibliographic entry see Field 02B.
9-08226

ON A METHOD OF FLOOD FORECASTING USING A DIGITAL COMPUTER CONNECTED WITH A WEATHER RADAR,
National Research Center for Disaster Prevention, Tokyo (Japan).
Masami Sugawara.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Int Ass Sci Hydrol, Pub No 80, Vol 1, pp 161-169, 1968. 9 p, 8 fig.

Descriptors: *Weather data, *Analog computers, *Digital computers, *Flood forecasting, Rainfall-runoff relationships, Radar, Remote sensing, Telemetry.
Identifiers: *Japan, *Hybrid computers.

Experiments were carried out in Japan using weather radar information, converted from analog to digital form, in a digital computer to forecast floods. The rainfall data were calibrated by comparison with rain gage data. Data were recorded on video tape for transportation from the radar installation to the computer. Because radar echoes are very high-frequency phenomena and floods are very low-frequency phenomena, information density at the radar site is reduced using the simplest analog method possible, and the resulting low-frequency data are presented on a polar coordinate mesh. (Knapp-USGS)
W69-08229

A COMPARATIVE ANALYSIS OF DIGITAL AND ANALOG COMPUTERS AS TO THEIR EFFECTIVENESS IN SOLVING RUNOFF ANALYSIS,
National Research Center for Disaster Prevention, Tokyo (Japan).
M. Sugawara.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Int Ass Sci Hydrol, Pub No 80, Vol 1, pp 170-174, 1968. 5 p, 4 fig, 2 ref.

Descriptors: *Rainfall-runoff relationships, *Computer models, *Analog computers, *Digital computers, Telemetry, Radar, Snowmelt, Runoff forecasting, Streamflow forecasting, Computers, Rainfall, Runoff, Forecasting.
Identifiers: *Japan, *Hybrid computers.

In Japan, digital rather than analog computers are used to analyze rainfall-runoff relationships. Analog computers are less flexible for many purposes than digital computers. For example, in calculating the effect of snow deposit and snow melt, or the effect of irrigation to paddy fields, analog computers are not effective. As hydrological data are mainly given in digital form, because of their low frequency, digital computers are convenient because of their digital input and output. To use analog computers with digital imput, systems which somewhat resemble hybrid computers may be constructed. Analog computers are effective for their proper purposes, so combining them with digital computers can result in powerful systems. An example is the connection of a digital computer with a weather radar. In this case, the analog system is set at the radar site as the preparatory system for a digital computer. (Knapp-USGS)
W69-08230

SOME REMARKS ON THE USE OF DIGITAL COMPUTERS AND HYDRAULIC METHODS FOR FLOOD ROUTING AND FLOOD FORECASTING PROBLEMS,
Institute of Hydrotechnical Research, Bucharest (Rumania).
For primary bibliographic entry see Field 02E.
W69-08232

PREPARATION, VERIFICATION AND USE OF A DIGITAL GROUNDWATER SIMULATION PROGRAM,
General Electric Co., Santa Barbara, Calif. TEMPO.
For primary bibliographic entry see Field 07C.
W69-08236

APPLICATIONS OF COMPUTER TECHNOLOGY TO HYDROLOGIC MODEL BUILDING,
Agricultural Research Service, Chickasha, Okla. Southern Plains Branch.
For primary bibliographic entry see Field 07C.
W69-08237

HYPOTHETICAL FLOOD COMPUTATION FOR A STREAM SYSTEM,
Corps of Engineers, Sacramento, Calif. Hydrologic Engineering Center.
For primary bibliographic entry see Field 07C.
W69-08239

AN OPERATIONAL SYSTEM FOR COMPUTER PREPARATION OF SHORT-TERM RIVER FORECASTS ON THE NORTH COAST OF CALIFORNIA,
Weather Bureau, Sacramento, Calif. River Forecast Center.
R. J. C. Burnash, and R. L. Ferral.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Int Ass Sci Hydrol, Pub No 80, Vol 1, pp 300-306, 1968. 7 p, 3 fig, 3 ref.

Descriptors: *River forecasting, *Digital computers, *Data processing, *California, Rainfall-runoff relationships, Antecedent precipitation, Snowpacks, Snowmelt, Rainfalls, Winds, Temperature, Runoff, Hydrographs, Synthetic hydrology, Runoff forecasting.
Identifiers: Northern California rivers.

The north coast of California is generally composed of mountainous basins ranging in altitude from sea level to elevations in excess of 6000 feet. Stream data sampling is concentrated in the lower elevations. Historical storms have produced runoff volumes in excess of 30 inches. Precipitation occurs primarily in the winter months, generally as snow in the upper elevations. A computerized technique is described which provides a timely discharge forecast. Precipitation includes an approximation of wind influences during the storm period and is determined for all basins from limited wind, temperature and precipitation data. Surface runoff is computed from antecedent rainfall, a seasonal parameter and effective basin rainfall. The outflow hydrographs for 15 basins are synthesized from surface and subsurface flow computations. (Knapp-USGS)
W69-08243

COMPUTATIONAL ANALYSES OF MOISTURE FLUX OVER NORTH AMERICA,
Travelers Research Center, Inc., Hartford, Conn.
For primary bibliographic entry see Field 02B.
W69-08244

OPERATIONAL STREAMFLOW FORECASTING WITH THE SSARR MODEL,
Weather Bureau, Portland, Oreg. River Forecast Center.
For primary bibliographic entry see Field 02E.
W69-08245

LAG TIME OF NATURAL CATCHMENTS,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 02E.
W69-08250

A REVIEW OF SOME APPLICATIONS OF MATHEMATICAL PROGRAMMING IN WATER RESOURCES ENGINEERING,
Technion - Israel Inst. of Tech., Haifa. Lowdermilk Faculty of Agricultural Engineering.
For primary bibliographic entry see Field 06A.
W69-08251

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AN OUTLINE OF POLAND'S HYDROGRAPHY (POLISH),
Warsaw Univ. (Poland). Faculty of Biology; Warsaw Univ. (Poland). Faculty of Geography; and Warsaw Univ. (Poland). Faculty of Geophysics.
Zdishaw Mikulski.
Available from Clearinghouse as TT65-50375 at $3.00 in paper copy. Warsaw, Poland, Sci Publications Foreign Coop Center of Cent Inst for Sci, Tech and Econ Inform. 1968. 337 p, 47 fig, 1 map, 28 tab, 331 ref.

Descriptors: Hydrography, *Surface waters, *Groundwater, Synoptic analysis, Climatology, Meteorlogy, Rainfall-runoff relationships, Surface-groundwater relationships, Streamflow, Rainfall, Runoff, Infiltration, Hydrologic budget, Evapotranspiration.
Identifiers: *Poland.

The groundwater and surface water hydrography of Poland are discussed in a textbook intended for professional hydrologists and water managers. Studies in synoptic hydrology, water resources planning, and water development economics are reviewed. The major topics discussed are geography of Poland, climate, groundwaters and springs, rivers, lakes and reservoirs, water balance, and water economy. (Knapp-USGS)
W69-08253

HYDROLOGY OF WETLAND FOREST WATERSHEDS,
Forest Service (USDA), Charleston, S. C. Southeastern Forest Experiment Station.
For primary bibliographic entry see Field 04A.
W69-08440

MULTIVARIATE STATISTICAL METHODS IN HYDROLOGY-A COMPARISON USING DATA OF KNOWN FUNCTIONAL RELATIONSHIP,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 07B.
W69-08499

SOME INTERPRETATIONS OF SEDIMENT SOURCES AND CAUSES, PACIFIC COAST BASINS IN OREGON AND CALIFORNIA,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Henry W. Anderson, and James R. Wallis.
US Dept Agr Misc Publ No 970 (1965): 22-30.

Descriptors: *Sediment discharge, *Reservoir silting, *Suspended load, *Erosion, Topography, Soil aggregation, Meteorology, Geology, Geomorphology, Road design, Watershed management, Forest management, Channel morphology, Mountains, Analytical methods, Regression analysis, Oregon, California.
Identifiers: Sediment sources, Hydrologic potential, Rain-snow areas, Erodability.

Brings together results of 10 studies that show that between manageable units of watersheds, sediment yield (erosion) was found to vary by a factor of 36 with differences in runoff potential, by a factor of two with differences in topography, by a factor of five with differences in geologic stability, and by a factor of six to 18 with differences in land use and condition. Rain and snow melt frequencies by elevation zones and latitude are tabulated. Erodibility indices of soils developed on some 27 different rock types are given.
W69-08501

WATERSHED MODELING APPROACH TO EVALUATION OF THE HYDROLOGIC POTENTIAL OF UNIT AREAS,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Henry W. Anderson.
International Symposium on Forest Hydrology, Proc (1965): 735-746. Pergamon Press - Oxford and New York - 1966.

Descriptors: *Hydrologic properties, *Environmental effects, *Analytical methods, *Statistical models, *Regression analysis, Watershed management, Snow cover, Snowmelt, Snow management, Sediment discharge, Mountains, Large watersheds, California, Mathematical models, Mathematical studies.
Identifiers: Principal components analysis, Factor analysis, Logging (Timber).

The hydrologic potential of forest sites can be interpreted from analyses of watershed models and models of hydrologic processes. This concept is illustrated by a model relating sediment discharge from forty-six watersheds in northern California to watershed variables, and by a model relating snow accumulation at 163 snow courses to variables of terrain, including forest variables. Factor analysis is used in testing the adequacy of sampling of independent variables; principal component regression analyses are used in establishing physical relations to sediment and snow. Factor contributions after varimax rotation allows improved interpretation of explained variance. Application of a model in evaluating flood sources and the sediment potential of unit areas is illustrated.
W69-08504

IMPORTANT WATERSHED CHARACTERISTICS AFFECTING WATER YIELD, FLOOD PEAKS AND EROSION AND SEDIMENTATION AND THE BASIC DATA NEEDED FOR PRODUCTION,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station; and Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 04D.
W69-08508

SOURCE AREAS OF STORM RUNOFF,
Tennessee Valley Authority, Knoxville.
Roger P. Betson, and John B. Marius.
Water Resources Res, Vol 5, No 3, p 574-582, June 1969. 9 p, 5 fig, 1 tab, 8 ref.

Descriptors: *Rainfall-runoff relationships, *Runoff, *Storm runoff, Routing, Antecedent precipitation, Soils, Piezometers, Rain gages, Permeability, Infiltration, Runoff forecasting.
Identifiers: Runoff source areas.

An investigation of runoff from a 4.64-acre agricultural watershed included the use of subplots, observation wells, and piezometers to determine the extent of source areas of storm runoff within the catchment. Studies of data collected showed that most of the storm runoff usually originates from a small portion of the total drainage area and that the location and extent of the source area is dependent upon rainfall intensity, antecedent moisture, and the depth of the A horizon soil. (Knapp-USGS)
W69-08569

OPTIMAL IDENTIFICATION OF LUMPED WATERSHED MODELS,
California Univ., Los Angeles.
John W. Labadie, and John A. Dracup.
Water Resources Res, Vol 5, No 3, p 583-590, June 1969. 8 p, 3 fig, 1 tab, 9 ref.

Descriptors: *Mathematical models, *Rainfall-runoff relationships, *Computer programs, Linear programming, Optimization, Parametric hydrology, Digital computers, Computer models, Model studies.
Identifiers: Nonlinear rainfall-runoff models, Quasilinearization.

Though several investigators have noted the consistent nonlinearity of hydrologic system response to rainfall, nonlinear models have been avoided because of computation difficulties associated with the identification of model parameters from historic records. A few nonlinear models have been proposed, but the parameter identification methods lack generality and the capacity to deal with complex models. Through quasi-linearizati implicit solutions to a large class of nonlin models can be written in terms of a maximiz operation on linear equations. This algorithm a provides for systematic determination of the timal values of model parameters in the identifi tion problem. Furthermore, a complete set of ac rate initial conditions need not be supplied. Ap cation of quasi-linearization to a recent nonlin conceptual model of watershed response displa in particular (1) the simplicity of the computer p gramming through the use of standard subrouti and (2) the rapid convergence characteristics the algorithm. (Knapp-USGS)
W69-08570

SOME APPLICATIONS OF CROSS-SPECTR ANALYSES IN HYDROLOGY: RAINFALL A RUNOFF,
Universidad Nacional del Zulia, Maraca (Venezuela); and Geological Survey, Fort Coll Colo.
Ignacio Rodriguez-Iturbe, and Carl F. Nordin.
Water Resources Res, Vol 5, No 3, p 608-621, J 1969. 14 p, 12 fig, 2 tab, 11 ref.

Descriptors: *Statistical methods, *Time se analysis, *Rainfall-runoff relationships, Correlat analysis, Frequency analysis, Regression analy Probability, Stochastic processes, Synthe hydrology.
Identifiers: Cross-spectral analysis.

Coherence and partial coherence between cy components of hydrologic time series show str correlations among annual oscillations in precip tion and runoff for stations located in the Pac Coast region of the United States. To distances 1000 km the annual cycle of precipitation can considered practically the same for all static Similar relations exist between records of stre flow, but the coherence is less because of varia watershed characteristics, evaporation, stora and other factors influencing runoff. (Kna USGS)
W69-08572

PATTERNS OF SUCCESSION OF DRY A WET YEARS AS A BASIS FOR COMPU TIONS OF STREAMFLOW REGULATION,
State Hydrological Inst., Leningrad (USSR)
For primary bibliographic entry see Field 07C.
W69-08613

SOME STATISTICAL METHODS IN T ANALYSIS OF HYDROLOGIC SERIES,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 07C.
W69-08614

THEORY OF STOCHASTIC PROCESSES HYDROLOGY AND RIVER RUNOFF REGU TION,
For primary bibliographic entry see Field 02E.
W69-08626

PRINCIPLES OF HYDROLOGY,
Hull Univ. (England). Dept. of Geography
R. C. Ward.
Maidenhead, Berkshire, England, McGraw-H Publishing Co, Ltd, 1967. 403 p, 145 fig, 6 tab, 5 ref.

Descriptors: *Hydrology, *Surface wat *Groundwater, Hydrologic cycle, Precipita (Atmospheric), Interception, Evapora Evapotranspiration, Soil moisture, Runoff, R fall-runoff relationships, Surface-groundwater r tionships.
Identifiers: Textbook.

Hydrology is discussed in a non-mathema manner in a comprehensive general textbook engineers which should also be of use to other

ing water managers, students, and the laymen a good basic scientific background. Numerous examples from the British Isles are given. An t is made to keep engineering and other ap- l aspects of hydrology to a minimum, so that discussion may be as close to 'pure' hydrology ssible in a basically applied science. Basic top- overed in detail include the hydrologic cycle, ipitation, interception, evaporation, otranspiration, soil moisture, groundwater, runoff. A bibliography is included at the end of chapter. (Knapp-USGS)
-08628

Precipitation

T BALANCE STUDIES DURING AN ICE- PERIOD IN FAIRBANKS, ALASKA,
ka Univ., College. Geophysical Inst.
primary bibliographic entry see Field 02C.
-08198

MPARISON BETWEEN RAIN GAGE AND IMETER MEASUREMENTS.
fornia Univ., Davis. Dept. of Water Science Engineering.
. Morgan, and F. J. Lourence.
er Resources Res, Vol 5, No 3, pp 724-728, 1969. 5 p, 1 fig, 2 tab, 6 ref.

criptors: *Rain gages, *Lysimeters, *Instru- tation, Rainfall, Wind, Precipitation (At- pheric), Calibrations, On-site tests, Quality trol, Sampling.
tifiers: Central Valley (Calif).

n-gage data were compared with ground-level ipitation as determined with a highly sensitive meter 20 ft in diameter. Rain gages of various s were tested in the Central Valley of Califor- during 24 storms in the 1966-1968 rainfall ons. Rainfall totals for each storm as measured he lysimeter and by several rain gages in its nity were compared by regression analysis. d effects on a standing gage seemed unimpor- , since agreement was close between a standard ch rain gage mounted in the normal standing tion and a USSR 3000-sq-cm rain gage unted at ground level. Storm totals from these 2 es spaced about 10 ft apart averaged 4% higher n catches measured 450 ft away by the lysimeter a Fischer and Porter digitizing rain gage spaced ut 10 ft apart. Fischer and Porter gage storm ch values varied generally about the mean value he lysimeter data. The coinciding means of all he data from these 2 instruments suggest that d effects compensate over the period of storms lied. (Knapp-USGS)
9-08208

OMORPHOLOGY,
delberg Univ. (West Germany); and Univer- et des Saarlandes, Saarbruecken (West Ger- y).
z Machatschek.
ed by H. Graul and C. Rathjens. New York, er Elsevier Publ Co, Inc, 1969. 9th Engl edition. p, 87 fig, 736 ref.

criptors: *Geomorphology, *Land forming, matology, Environmental effects, Erosion, logic control, Glaciers, Structural geology, ography, Weathering, Soil formation, iographies.
tifiers: Textbooks.

English translation of a standard German norphology test is presented as an introduction e subject for the serious student. The bibliog- y is extensive, and particularly complete in rences to German and French work. The ef- s of various climates on tectonic landforms is sed. The topics discussed include orogeny, rogenic movements, volcanism, earthquakes, thering, soil formation, mass movements, flu- le landforms, major landform types, climatic differentiation of landforms, humid climate landforms, glacial landforms, arid climate landforms, coastal landforms, and anthropogenic effects. (Knapp-USGS)
W69-08226

A DIGITAL COMPUTER PROGRAM TO PLOT ISOHYETAL MAPS AND CALCULATE VOLUMES OF PRECIPITATION,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 07C.
W69-08238

COMPUTATIONAL ANALYSES OF MOISTURE FLUX OVER NORTH AMERICA,
Travelers Research Center, Inc., Hartford, Conn.
J. G. Welsh, H. M. Frazier, and P. Boch.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Int Ass Sci Hydrol, Pub No 80, Vol 1, pp 307-316, 1968. 10 p, 3 fig, 2 tab, 27 ref.

Descriptors: *Meteorology, *Data processing, *Digital computers, *Weather forecasting, Hydrologic budget, Heat flow, Mass transfer, Computer programs, Atmospheric physics, Air masses, Distribution patterns, Evaporation, Humidity, Synoptic analysis.
Identifiers: Flux divergence, Moisture flux.

Terrestrial water budgets may be evaluated by balancing horizontal and vertical transfers of water into and out of the air space above a given drainage basin. Such hydrometeorological studies have been performed for the 5-year period May 1958-April 1963, for the North American region using high-speed electronic data processing machines to perform the analyses. The generation of vertically integrated moisture and moisture transport statistics for some 176 North American stations are described for each of the 60 months based on meterological statistics at each of 16 levels in the atmosphere from the surface to 300 millibars. Covariances were computed for wind components and specific humidity data for each day of the 5 years for each station, then summed and analyzed to yield 89 time-averaged fields (maps) of flux divergence of moisture over North America, and other maps of velocity potential, streamlines, and zonal and meridional transport terms. The complex of computer programs to perform these analyses is described. The resulting inventory of moisture flux data over North America represents the most complete analysis to date of the atmospheric limb of the hydrologic cycle. (Knapp-USGS)
W69-08244

VARIATIONS IN PRECIPITATION FROM THUNDERSTORMS IN THE SOUTHWEST,
Agricultural Research Service, Tucson, Ariz. Southwest Watershed Research Center.
Herbert B. Osborn.
5th Proceed, Conference on Severe Local Storms, Amer Meteorological Society, St Louis, Mo, pp 219-225, October, 1967. 7 p, 7 fig, 2 ref.

Descriptors: *Thunderstorms, *Variability, *Southwest U.S., Arid lands, New Mexico, Arizona, Acreage, Areal, Demonstration watersheds, Rainfall disposition, Small watersheds, Hail, Isohyets, Precipitation intensity, Rain, Weather patterns, Storm runoff.
Identifiers: Alamogordo Creek watershed, Walnut Gulch watershed.

Eleven years of records from dense networks of recording rain gages on 67 sq. mi. Alamogordo Creek watershed (N.M.) and 58 sq. mi. Walnut Gulch watershed (Ariz.) are indicative of thunderstorm patterns in the arid Southwest. Point intensities for 5 min. periods sometimes approached 10 in/hr. on the Walnut Gulch watershed, while on Alamogordo Creek they have exceeded 15 in/hr. Two exceptional storms at Alamogordo Creek produced over 3 in. of precipitation in 15 min. On the Walnut Gulch watershed, the runoff-producing portion of most thunderstorms lasted for less than 15 min. and covered less than 5 sq. mi. 90% of all thunderstorms lasted less than 30 min. Only with intense networks of rain gages is it possible to accurately measure the frequencies of thunderstorms of varying magnitudes and durations on 60 sq. mi. watersheds and on the semiarid rangelands of the Southwest. (Sherbrooke-Ariz)
W69-08309

THE RESPONSE OF WATER TEMPERATURES TO METEOROLOGICAL CONDITIONS,
Vanderbilt Univ., Nashville, Tenn.; Office of the Surgeon General (Army) (South Vietnam); and Johns Hopkins Univ., Baltimore, Md.
For primary bibliographic entry see Field 01A.
W69-08417

THE GENERATION OF SPRING PEAK FLOWS BY SHORT-TERM METEOROLOGICAL EVENTS,
Forest Service (USDA), Moscow, Idaho. Forestry Sciences Lab.
For primary bibliographic entry see Field 02C.
W69-08435

EFFECTS OF HURRICANE STORMS ON AGRICULTURE,
Colorado State Univ., Fort Collins.
L. M. Hartman, David Holland, and Marvin Giddings.
Water Resources Res, Vol 5, No 3, pp 555-562, June 1969. 8 p, 3 tab, 22 ref.

Descriptors: *Hurricanes, *Damages, *Crop production, Catch crops, Economics, Winds, Rainfall, Infiltration, Runoff, Erosion, Statistical methods, Regression analysis, Storms.
Identifiers: Hurricane effects on agriculture.

Hurricane storms as they move inland are accompanied by rather widespread rainfall. The effect of the rainfall on crop production depends upon the time occurrence of the storm. A statistical time series analysis of the relation between rainfall by time periods and crop yields indicates that rainfall during the major hurricane season (August, September, and October) is damaging to many crops. The analysis consisted of a multiple regression of crop yields on rainfall by 10-day time intervals. The total benefit or loss from any storm would depend upon the time occurrence and the track of the storm. A summary of change by states in total crop value from 1 inch of incremental rainfall for their 5 major crops resulted in both positive and negative totals, depending upon the time period. Predicted changes in yield and crop value for 3 historic storms indicate net losses for 2 storms occurring in August and September and net benefits for 1 storm occurring in July. (Kanpp-USGS)
W69-08568

PRECIPITATION IN NORTHERN QUEBEC AND LABRADOR: AN EVALUATION OF MEASUREMENT TECHNIQUES,
Department of Transport, Toronto (Ontario). Meteorological Branch.
B. F. Findlay.
Arctic, Vol 22, No 2, pp 140-150, June 1969. 11 p, 4 fig, 2 tab, 18 ref.

Descriptors: *Precipitation (Atmospheric), *Precipitation gages, *Arctic, *Cold regions, *Measurement, Calibrations, Snow, Rain, Winds, Hydrologic Budget, Synoptic analysis, Snow surveys, Gaging stations, Interception, Evapotranspiration.
Identifiers: Quebec, Labrador, Canada.

A testing of published maps of precipitation normals for a continental subarctic area using hydrological techniques suggests a systematic annual error of 6 inches (152 mm.). The scope of the analysis is subcontinental, but point values for a central climatological station are used to elucidate

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indirect techniques available for the adjustment of precipitation gage data. These methods include snow surveying, stream gaging, interception and evapotranspiration calculations and watershed rain gage networks. All hydrological parameters are characterized by inherent errors in measurement and short periods of record. Consequently, the results of this investigation should be considered speculative. (Knapp-USGS)
W69-08587

2C. Snow, Ice, and Frost

HEAT BALANCE STUDIES DURING AN ICE-FOG PERIOD IN FAIRBANKS, ALASKA,
Alaska Univ., College. Geophysical Inst.
Gerd Wendler.
Mon Weather Rev, Vol 97, No 7, pp 512-520, July 1969. 9 p, 9 fig, 2 tab, 21 ref.

Descriptors: *Fog, *Alaska, *Ice, *Heat balance, Solar radiation, Heat budget, Weather, Climates, Smog, Air pollution effects, Condensation.
Identifiers: *Ice fog, Fairbanks (Alaska).

Ice fog, which is in a way similar to a dense cirrostratus cloud near the surface, occurs in Fairbanks when the temperature drops below -35 deg. C. The heat balance of two stations, one below the ice fog in the valley and the other one on Birch Hill above the ice fog, are compared for the longest cold spell in winter 1966/67. The valley station shows a relatively small radiative loss of 47 cal per sq cm per day, as the ice fog shelters the surface against a highly negative long-wave radiation balance. The energy for compensation of this loss comes mostly 25 cal per sq cm per day out of the soil. On Birch Hill the radiative loss (124 cal per sq cm per day) is nearly three times larger, mostly due to the smaller amount of the incoming long-wave radiation, and here the sensible heat flux (102 cal per sq cm per day) provides most of the energy. (Knapp-USGS)
W69-08198

A SIMPLE SNOWMELT LYSIMETER,
Forest Service (USDA), Ogden, Utah. Intermountain Forest and Range Experiment Station.
Harold F. Haupt.
Water Resources Res, Vol 5, No 3, pp 714-718, June 1969. 5 p, 1 tab, 7 ref.

Descriptors: *Snow, *Lysimeters, *Snowmelt, Instrumentation, Snow cover, Snowfall, Snow management, Streamflow forecasting, Runoff forecasting.
Identifiers: *Snow gages.

A simple gage on the lysimeter principle has been developed to provide continuous readings of the volume of water flowing from the base of a snowpack in the form of surface melt alone or rain percolate and surface melt combined. The data obtained show promise, after two seasons, of being applicable in river flood forecasting, as well as in studies of snow hydrology. (Knapp-USGS)
W69-08206

SNOW ACCUMULATION ON MOUNT LOGAN, YUKON TERRITORY, CANADA.
Cold Regions Research and Engineering Lab., Hanover, N. H.
C. M. Keeler.
Water Resources Res, Vol 5, No 3, pp 719-723, June 1969. 5 p, 4 fig, 1 tab, 10 ref.

Descriptors: *Snowfall, *Cold regions, *Mountains, Topography, Snow surveys, Elevation, Orography, Meteorology.
Identifiers: *Mt. Logan (Canada), Yukon Territory (Canada).

Measurement of snow accumulation for the year from summer 1967 to summer 1968 on Mt. Logan, St. Elias Mountains, Yukon Territory, Canada, indicates that annual precipitation is approximately 0.65 meters per year for elevations between 3350 and 5400 meters. This is less by a factor of 5 than annual precipitation at sea level on the Gulf of Alaska. On a regional basis precipitation decreases inland from the Pacific Ocean at a rate of approximately 0.00002 meters per km. Precipitation decreases on the windward and increases on the leeward sides of the St. Elias Mountains with respect to elevation. (Knapp-USGS)
W69-08207

GLACIER MASS-BALANCE MEASUREMENTS--A MANUAL FOR FIELD AND OFFICE WORK,
Department of Energy, Mines and Resources, Ottawa (Ontario); and Norwegian Water Resources Board, Oslo.
G. Ostrem, and A. Stanley.
Can Dep Energy, Mines and Resources and Norwegian Water Resources and Elec Board Rep, 1969. 127 p, 20 fig, 25 photo, 7 tab, 55 ref.

Descriptors: *Glaciers, *Surveys, *Regimen, Movement, Glaciation, Melting, Suspended load, Scour, Climatic data, Ablation, Snowfall, Melt water, Data collections, Investigations, Mapping, Measurement, Profiles, Surveying instruments, Climatology, Discharge (Water).
Identifiers: *Glaciology, Glaciological field work manual.

Field procedures used by the Canadian Department of Energy, Mines, and Resources and the Norwegian Water Resources and Electricity Board to collect glacial mass-balance data are described in a field manual. The manual describes standard field techniques, outlines practical difficulties and their solutions, gives practical field work hints, and suggests methods of recording, tabulating, and plotting data. Topics discussed include stake networks, accumulation measurements, ablation measurements, plotting and contouring, meteorological observation, water discharge measurements, suspended load measurement, surveying, field camp accomodations, field organization, and office procedures. An extensive bibliography is given. (Knapp-USGS)
W69-08227

HEAT BUDGET OF AN ICE COVERED INLAND LAKE,
Wisconsin Univ., Madison. Dept. of Meteorology.
For primary bibliographic entry see Field 02H.
W69-08404

THE GENERATION OF SPRING PEAK FLOWS BY SHORT-TERM METEOROLOGICAL EVENTS,
Forest Service (USDA), Moscow, Idaho. Forestry Sciences Lab.
Harold F. Haupt.
Bulletin of the Int. Assoc. of Scientific Hydrology, 1968. 13 (4): 65-76, Illus.

Descriptors: *Peak discharge, *Meteorology, *Rainfall intensity, *Snowmelt, Watersheds (Basins), Streamflow, Snowpacks, Storm runoff, Melt water.
Identifiers: Priest River Experimental Forest, Hydrometeorology.

Spring peak flows recorded over a 25-year period in Benton Creek, a small forested watershed (1.5 mi2) in northern Idaho, were studied in relation to meteorological events. The analysis revealed: (1) Slightly more than one-half of the spring peaks (56 percent) were associated with rain-on-snow events; less than one-half (44 percent) were associated with snowmelt events; (2) the timing of maximum spring discharge for years of rain-on-snow peaks was more closely synchronized with the ending day of maximum rainfall than it was for years of snowmelt peaks with the ending day of maximum temperatures; (3) in some years, heavy rainfall accompanied by relatively high air temperatures affected the generation of spring peak runoff, whereas in other years, heavy rainfall had a strong suppressing effect on air temperature so that snowmelt contribution to runoff was probably less and peak volumes did not occur; and (4) the highest peak runoff of record was a snowmelt event.
W69-08435

SNOW CATCH BY CONIFER CROWNS,
Forest Service (USDA), Moscow, Idaho. Forestry Sciences Lab.
Donald R. Satterlund, and Harold F. Haupt.
Water Resources Research, 1967, 3 (4): 1035-1039, Illus.

Descriptors: *Interception, *Snow, *Coniferous trees, *Idaho, Water loss, Mathematical models, Storage.
Identifiers: Priest River Experimental Forest, Interception storage.

Study of interception storage of snow by two species of sapling conifers in northern Idaho revealed that cumulative snow catch follows a classical law of autokinetic growth, or I (s)= S/ (1+ e to the -k (P-P (o))power) where I (s) is interception storage, S is the interception storage capacity of the tree, e is the base of the natural logarithm, k is a constant expressing the rate of interception storage, P is accumulated snowfall, and P (o) is accumulated snowfall at the time of most rapid storage (i.e., the point of inflection of the sigmoid curve). Interception storage conformed to the law in five storms in which snowfall began while the trees were bare, and in two storms in which snow fell while snow from previous storms persisted on the trees. Several small storms yielded insufficient data to define the appropriate constants, but inspection indicated no serious deviation from the general law.
W69-08436

AVALANCHE TECHNOLOGY AND RESEARCH, RECENT ACCOMPLISHMENTS AND FUTURE PROSPECTS,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station
M. Martinelli, Jr.
Weatherwise, Vol 19, No 6, p 232-239, Dec 1966. 7 p, 9 fig.

Descriptors: *Avalanches, Structures, Instrumentation, Meteorology, *Snowpacks, Control structures, *Snow management, Explosions.
Identifiers: Avalanche hazard evaluation, Avalanche forecasting, Avalanche control, Supporting structures, Avalanche control structures, Avalanche research, *Snow avalanches.

Research carried out in 1930 in Switzerland formed the scientific basis of avalanche hazard evaluation from weather factors and avalanche control using structures and vegetation. Some types of avalanche control structures are used to prevent avalanches from starting; other types protect valuable property or confine or restrict avalanche motion. The intentional release of avalanches by explosion is another type of avalanche control. Avalanche motion studies have been carried out in Europe and Japan. European studies are based on hydraulic principles; Japanese on experimental tests and measurements. Avalanche classification and avalanche hazard evaluation are still highly subjective. Research on these and other avalanche topics is underway in many countries. (Martinelli-USDA Forest Service)
W69-08444

SNOW AVALANCHES ALONG COLORADO MOUNTAIN HIGHWAYS,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station
Hans Frutiger.
USDA, Forest Service Res Paper RM-7, Jul 1965. 85 p, 3 fig, 1 tab.

Descriptors: *Avalanches, Colorado, Highways, Control structures, Explosions, *Snowpack, *Snow management.

tifiers: Avalanche paths, Avalanche control, lanche classification.

avalanche paths along four mountain passes in ral Colorado are named illustrators and ribed in detail. The most appropriate method controlling each avalanche is outlined on the s of available records and field investigations. rtinelli-USDA Forest Service)
)-08445

W COVER AND AVALANCHES IN THE H ALPINE ZONE OF WESTERN UNITED TES,
st Service (USDA), Fort Collins, Colo. Rocky ntain Forest and Range Experiment Station.
ur Judson.
ics of Snow and Ice, Proc International Conce on Low Temperature Science 1966, Vol 1, 2, p 1151-1168, 1967. 9 fig, 1 tab, 6 ref.

criptors: *Avalanches, *Snow cover, *Snow- Climatic data, Alpine, Rocky Mountain Re- , Weather, Precipitation (Atmospheric), tals, Snowpacks, Snow management.
tifiers: Colorado, Slab avalanches, Snow cover igraphy, Avalanche hazard forecasting, Snow iles, Avalanche fatalities.

d on 17 years of alpine snow and avalanche rds from a high mountain pass in Colorado esentative of conditions in the High Alpine e of Western United States Characteristics are n for 80 avalanche tracks in Colorado. 80% of valanches were slab avalanches and soft slabs e most frequent. Bimonthly snow cover data, n pits in a level test field in the timber, includes: n shape, grain size, snow temperatures, temture gradients, density, and hardness in each r. Means and extremes of these parameters are ussed, and a comparison is made of test field with profiles from five adjacent avalanche sites. depth, grain shape, and strength of the snow in lowest layer at the test field was similar to that earby avalanche starting zones. Greatest difnce was found in the strength and thickness of middle layers of the pack. This attributed to d action at the avalanche sites. Discusses anche hazard forecasting with reference to the of snowpits and weather data in the High Al- Zone; outlines the use of precipitation data to rmine when to start avalanche control during or storms. (Martinelli-USDA Forest Service)
9-08446

MANUAL FOR PLANNING STRUCTURAL NTROL OF AVALANCHES,
st Service (USDA), Fort Collins, Colo. Rocky ntain Forest and Range Experiment Station.
s Frutiger, and M. Martinelli, Jr.
)A, Forest Service Res Paper RM-19, May 6. 68 p, 37 fig, 3 tab, 38 ref.

criptors: *Avalanches, Structures, Meteorolo- *Control structures, *Snowpacks, *Snow agement.
tifiers: Avalanche structures, Avalanche con- Case history.

lanche classification for control purposes ld include frequency of occurrence and her dry or wet avalanches are most common. anche areas consist of a catchment basin with or more starting zones, the track and runout . Structural control of avalanches started in zerland over a century ago. Early structures built from materials at the site; earthen nds and dams or wooden barriers. Modern tures utilize concrete, steel, aluminum as well ood and earth. Supporting structures in the ing zone must be designed to withstand creep glide pressures; the empirical means of doing e given in formulae and nomographs. Snow control and diversion and retarding structures also be used under certain stipulated condi- . The field information necessary for planning nche control installations is outlined and a case example is presented. (Martinelli-USDA Forest Service)
W69-08447

THE WEATHER AND CLIMATE OF A HIGH MOUNTAIN PASS IN THE COLORADO ROCKIES,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
Arthur Judson.
USDA, Forest Service Res Paper RM-16, Nov 1965. 28 p, 26 fig, 15 tab.

Descriptors: *Snowfall, *Snow cover, *Air temperature, *Winds, Wind velocity, Climatic data, Weather data, Storms, Meteorology, Rocky Mountain Region, *Avalanches, Snowpacks.
Identifiers: Mountain meteorology, Alpine areas, Colorado, Return periods.

Presents information basic to mountain meteorology and avalanche-control planning from Berthoud Pass--an area representative of Colorado's avalanche zones near timberline. Describes and illustrates wind, temperature, snowfall, snow depth, rainfall, and related weather patterns from data collected irregularly 1926-49, continuously since then. Compares direction and windspeeds at surface at Berthoud Pass with 4,000 m. winds over Denver and Grand Junction. Analyzes weather relationships of 10 large winter storms at the Pass. (Martinelli-USDA Forest Service)
W69-08448

AN EXAMPLE OF DAMAGE FROM A POWDER AVALANCHE,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
M. Martinelli, Jr., and K. D. Davidson.
Bulletin of International Association of Scientific Hydrology, XI (e) Annee No 3 pp 26-34, 1966. 9 p, 4 fig.

Descriptors: *Avalanches, *Snowpacks, *Atmospheric physics, *Velocity, Equations.
Identifiers: Powder avalanches, Airblast, Avalanche accident, Avalanche damage, *Snow avalanches.

A powder avalanche moved a 3,200 kg truck 19.8 m horizontally and dropped it 15.2 m into a gully without serious damage. Data from the site are used to compute the velocity of snow-free air and of a snow-air mixture necessary to cause this event. These velocities are found to be within the velocity of the avalanche as estimated from the equations published by A. Voellmy. (Martinelli-USDA Forest Service)
W69-08449

INFLUENCE OF GAP WIDTH BELOW A VERTICAL SLAT SNOW FENCE ON SIZE AND LOCATION OF LEE DRIFT,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
M. Martinelli, Jr.
Bulletin of the International Association of Scientific Hydrology, IX (e) Annee No 4, pp 48-57, 1964. 10 p, 5 fig, 2 tab, 3 ref.

Descriptors: *Snow, *Snow management, *Snowpacks, Structures, Control structures, Meteorology.
Identifiers: Snow fences, Snow accumulation, Snow drifts.

When vertical slat snow fences were built with gaps of 1, 2, and 4 feet below 6 feet of fencing, maximum snow depth and maximum snow volumes were found in the lee drifts behind the fences with the 1-foot gap. As gap size increased, maximum snow depth moved farther from the fence and decreased. The volume of snow in the lee drifts behind fences with 2- and 4-foot was about the same, but amounted to only a little over one-half that behind fences with 1-foot gaps. The 1-foot gap became plugged with snow even in the below-average snow year studied. This caused maximum snow depths to move toward the fence. (Martinelli-USDA Forest Service)
W69-08450

SOME OBSERVATIONS ON TEMPERATURE PROFILES OF A MOUNTAIN SNOW COVER,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
James D. Bergen.
Rcoky Mountain Forest and Range Experiment Station, USDA Forest Service Research Note RM-110, 1968. 7 p, 4 fig, 4 ref.

Descriptors: *Snow, *Snow cover, *Thermal stratification, *Climatology, Mountain forests, Heat transfer, *Density stratification, Temperature, Snow surveys, Microenvironment, Cold resistance.

Measurements of the vertical temperature distribution in an annual mountain snow cover are discussed in terms of a simple model of the vertical temperature profile. The parameters describing this model are compared for measurements made for 2 winters. Day-to-day variation is found to be larger for these parameters than between different months of the same winter or between the 2 winters.
W69-08451

ATMOSPHERIC HUMIDITY MEASUREMENT NEAR THE SNOW SURFACE,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
James D. Bergen.
Rocky Mountain Forest and Range Experiment Station, USDA Forest Service Research Note RM-116, 1968. 4 p, 3 fig, 5 ref.

Descriptors: *Hygrometry, *Boundary layers, *Snow cover, Humidity, Microenvironment, Moisture content, Boundary processes, Evaporation, Latent heat, Vapor pressure, Sublimation.
Identifiers: Bowen ratio.

Describes a technique for measuring atmospheric humidity in the first few centimeters over a snow cover. Results are presented for four observation periods. The water vapor density at a nominal reference level of 2 cm above the snow surface was found to vary from less than 20 percent to 90 percent of the density corresponding to saturation at the snow surface temperature. Little diurnal variation was found for the Bowen ratio. Possible remedies for difficulties encountered in the measurements are described.
W69-08452

SOME MEASUREMENTS OF AIR PERMEABILITY IN A MOUNTAIN SNOW COVER,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
James D. Bergen.
Bulletin of the International Association of Scientific Hydrology, XIII (e) Annee No 3, pp 5-13, 1968. 7 p.

Descriptors: *Snow, *Snow cover, *Snowpacks, *Physics, *Permeability, Mass transfer, Air, Flow resistance, Porous media, Mountain forests, Snow surveys, Sublimation.
Identifiers: *Snow metamorphosis.

Air permeability and density at various levels in an annual mountain snow cover were measured on three separate days in mid-February, early March, and late March, respectively. Permeabilities are presented together with estimates of grain size based on the empirical correlations between grain size and air permeability found in the literature. The variation of air permeability with absolute porosity for various snow types is compared with that found in the literature for a Swiss alpine snow cover and found to be in fair agreement. Grain size

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in the depth hoar layer is found to decrease by a third over the last period.
W69-08453

AREAL EXTENT OF SNOW COVER IN RELATION TO STREAMFLOW IN CENTRAL COLORADO,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
Charles F. Leaf.
Int Hydrol Symp Proc, 1967 (vol 1): 157-164 illus.

Descriptors: *Aerial photography, *Runoff forecasting, *Snow cover, *Streamflow forecasting, Flood forecasting, Forecasting, Model studies, Photogrammetry, Remote sensing, Snowmelt, Snowpacks, Snow surveys, Terrain analysis, Simulation analysis.
Identifiers: *Snow-cover depletion, Areal snow cover.

Aerial photography indicates that snow depletion rates are highly correlated with seasonally generated runoff volumes. Patterns of snow depletion and generated runoff have been consistent from year to year, even though the amount of snow and weather conditions which produced runoff were not the same.
W69-08454

PHYSICAL AND ECONOMIC DESIGN CRITERIA FOR INDUCED SNOW ACCUMULATION PROJECTS,
Forest Service (USDA), Laramie, Wyo. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 03B.
W69-08459

A SHIELDED THERMISTOR WITH PORTABLE INSTRUMENT FOR MEASURING SNOWPACK TEMPERATURES,
Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 07B.
W69-08469

OBSERVATIONS OF SNOWPACK ACCUMULATION, MELT, AND RUNOFF ON A SMALL ARIZONA WATERSHED,
Forest Service (USDA), Flagstaff, Ariz. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 03B.
W69-08493

OBSERVATIONS OF SNOW ACCUMULATION AND MELT IN DEMONSTRATION CUTTINGS OF PONDEROSA PINE IN CENTRAL ARIZONA,
Forest Service (USDA), Flagstaff, Ariz. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 03B.
W69-08494

USE OF NUCLEAR TECHNIQUES IN SNOW AND RELATED WATERSHED MANAGEMENT,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 07B.
W69-08496

MANAGING CALIFORNIA'S SNOW ZONE LANDS FOR WATER,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 03B.
W69-08498

SNOW ACCUMULATION AND MELT IN RELATION TO TERRAIN IN WET AND DRY YEARS,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Henry W. Anderson, and Allan J. West.
33rd Ann Western Snow Conf, Proc (1965): 73-82.

Descriptors: *Snow cover, *Snowmelt, *Environmental effects, Topography, Elevation, Slope, Analytical techniques, Regression, Coniferous forests, Mountains, California, Snowpacks.
Identifiers: *Forest openings, *Principal components analysis.

To determine terrain-snow relations three years with wide differences in snow accumulation and melt,--1958, 1959, and 1960, and snow water equivalent on March 1, April 1, and May 1 in each of those years were analysed separately by regression on principal components. Terrain effects on snow were expressed in two parts: first, the meso-terrain, representing the surroundings within a few hundred or thousands of feet around the course; and second, the local terrain at the snow course. Snow differences with elevation become greater as the season progresses from March 1 to May 1, especially in dry years. One implication is that snow sensors, such as snow pillows or radioactive snow gages, at a single elevation cannot index snow at all elevations in different years. For snow courses in forest openings, the width of the openings had more effect in the year of heavy snowfall than in the dry years. In the wet year, 1958 snow was 3 to 3 1/2 inches greater in an opening 4 tree heights across than in an opening only one tree height across; however, in dry years 1959 to 1960 the differences averaged less than one inch. Cold air drainage obviously plays a role in delaying snowmelt in openings as well as in the forest adjacent to openings. The increase in snow in the downhill half of openings as contrasted to the uphill ranged from 3 to 5.5 in.; in the adjacent forest the downhill portions had 2 to 3.5 inches more, with differences increasing with season (March 1 to May 1).
W69-08500

INTEGRATING SNOW ZONE MANAGEMENT WITH BASIN MANAGEMENT,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 03B.
W69-08503

SNOW ACCUMULATION AS RELATED TO METEOROLOGICAL, TOPOGRAPHIC, AND FOREST VARIABLES IN CENTRAL SIERRA NEVADA, CALIFORNIA,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Henry W. Anderson.
Int Ass Sci Hydrology Publ No 78 (1967): 215-224.

Descriptors: *Snow cover, *Snow management, *Snow fall, *Interception, *Snowpacks, Cloud cover, Advection, Heat budget, Humidity, Solar radiation, Topography, Mountain forests, Watershed management, Analytical techniques, California.
Identifiers: Forest patterns, Forest canopy, Snow distribution, Principal components analysis.

Snow accumulation at individual points in forest and openings in forests was studied by selecting 16 periods in the winter of 1957-58 under different meteorological conditions. Wide differences in topography and forest conditions were obtained by selection of 250 points from 1,300 available. Snow accumulation was the difference in water equivalent of the snow pack between measurements. Meteorological variables included functions of clouds, wind, humidity, temperature, and precipitation. Forest variables included indexes of shade, back radiation, interception, cold air drainage, and shelter from the wind. Topography was expressed in terms of solar energy received and exposure to prevailing winds. The factors related to snow accumulation were studied by reduced rank procedure of principal components, principal axis, canonical, and alpha factoring with varimax rotation of the factors. The best regressions relating the variables to snow accumulation arose from principal components analysis when highly correlated variables were included. Snow accumulation depended strongly on combinations of meteorologic and forest variables, and on forest-meteorologic interactions. Interception of snow, as indexed b the canopy over the point, averaged 10 percent the precipitation. Snow accumulation in fore openings, forest margins, and in large areas uniform forest had different relations to meteorlo ical and topographic variables. Forest shade a back radiation from trees were most important high energy south slopes.
W69-08506

GLACIAL AND FLUVIO-GLACIAL FORMA TIONS OF THE LYON REGION (FRENCH),
Lyon Univ. (France). Dept. of Earth Sciences.
L. David.
Doc Lab Geol Fac Sci, Lyon, No 22, 1967. 159 37 fig, 23 plate, 56 ref.

Descriptors: *Glaciers, *Sediments topograph Geology, Alluvium, Geomorphology, Mud, Loes Sands, Gravels, Canals, Streamflow, Maps, Wells
Identifiers: *France, Lyon region, Glacier deposit

Glacier deposits of the Lyon region, France, we investigated on the basis of earlier publication The monogram contains the following chapter (1) general considerations; (2) external domai (3) intermediate domain; (4) interior doma (natural of alluvium deposits, morphology, radi hills ravines); (5) some general problems; and (6 conclusions. The result of this detailed investig tion is a much better understanding of the geolog cal history of the Lyon region during its perio glaciation, although this period is limited in tim and space. (Gabriel-USGS)
W69-08627

2D. Evaporation and Transpiratio

WATER YIELD CHANGES AFTER CONVER ING A FORESTED CATCHMENT TO GRASS,
Forest Service (USDA), Tempe, Ariz. Fore Hydrology Lab.
For primary bibliographic entry see Field 03B.
W69-08200

ANTITRANSPIRANTS RESEARCH AND IT POSSIBLE APPLICATION IN HYDROLOGY,
California Univ., Davis.
David C. Davenport, Robert M. Hagan, and Paul I Martin.
Water Resources Res, Vol 5, No 3, pp 735-74 June 1969. 9 p, 4 fig, 1 tab, 33 ref.

Descriptors: *Transpiration control, *Water co servation, Chemcontrol, Stomata, Water yiel Water management (Applied), Watersh management.
Identifiers: *Antitranspirants.

Research on antitranspirants may have applicati in increasing the yield of water from watersheds reducing transpirational losses from vegetati under certain environmental conditions. There a 3 broad groups of antitranspirants: (1) reflecti materials that decrease the heat load on the le (2) film-forming materials that hinder the escape water vapor from the leaf, and (3) stomata-closi materials that increase stomatal resistance. A titranspirants are most effective in decreasi transpiration when other resistances in the passa of water to the roots, through the plant, and to t atmosphere are not great, when there is go coverage of the stomatal bearing leaf surfaces (e cept for reflecting materials), when new fol growth following treatment is minimal, and wh optimum concentrations and application rates used. (Knapp-USGS)
W69-08210

COMPARISON OF MATERIALS FOR REDU ING EVAPORATION OF SOIL MOISTURE WATER EFFICIENCY STUDIES.
Arizona Univ., Tucson. Dept. of Agronomy.
A. K. Dobrenz, D. F. Cole, and R. J. Joy

ronomy Journ, Vol 60, p 446, July-Aug, 1968. 1
1 fig, 6 ref.

scriptors: *Evaporation control, Soil sealants, rface sealing, Arid climates, Perlite, Growth ımbers, Soil-water-plant relationships, ıthwest U.S.
ntifiers: *Water efficiency studies, *Styrofoam, rmiculite, Pea gravel, 20-mesh sand.

is study tested the ability of several materials to luce evaporation of soil moisture from 4.2 liter e cans in which multi-stemmed, tillering plants re being tested for water efficiency in a growth ımber programmed for environmental condi-ns of the southwestern U.S. Coarse styrofoam luced evaporation by 78%, which was signifi-ıtly greater than the other six materials (fine rofoam, pea gravel, 20-mesh sand, perlite, ver-culite and bare soil). Coarse styrofoam is non-ic, permeable, light weight, and easy to apply. ıerbrooke-Ariz)
59-08292

TENTIAL EVAPOTRANSPIRATION AND ANT DISTRIBUTION IN WESTERN STATES ITH EMPHASIS ON CALIFORNIA,
lifornia Univ., Davis. Dept. of Botany.
ck Major.
ner Assoc Advance Sci Publ 86, 93-126, 1967.
p, 14 fig, 7 tab, 46 ref.

scriptors: *Climatic zones, *Vegetation, apotranspiration, California, Arid climates, serts, Semi-arid climates, Coasts, Climatic data, stribution patterns, Water balance, Moisture ailability, Great Basin.
ntifiers: *Potential evapotranspiration, *Far estern States, Sierran vegetation, San Joaquin lley.

veral types of Far Western vegetation (coastal getation, Central Valley vegetation, Sierran getation, Northern Great Basin vegetation and uthern Desert vegetation) are correlated with matic factors such as water deficit, water surplus, tual evapotranspiration and potential apotranspiration. The data emphasize the cli-ıtic diversity of the terrain occupied by many ınt formations rather than the reverse. There is one to one correspondence between climates d vegetation types in the Western states. Of the broad vegetation types suggested by Kunz and ck as making up California's vegetation, at least third occur in the same regional climate as other quite different type. Therefore, these are t primarily climatically determined. (Sher-ıoke-Ariz)
59-08308

TENTIAL EVAPOTRANSPIRATION IN MID AND ARID CLIMATES,
ssouri Univ., Columbia. Dept. of Soils.
ıyne L. Decker.
ıceed, Conference on Evapotranspiration and its le in Water Management, Amer Soc Agric En-eers, Chicago, p 23-26, 4 fig, 1 tab, 11 ref 1966.
. OWRR 14-01-0001-838.

scriptors: *Evapotranspiration, *Arid climates, umid climates, Elevation, Latitudinal studies, matic data, Energy budget, Heat balance, Irriga-ı effects.

s paper evaluates the concept of potential potranspiration and its relationship to various ıatic conditions. Attempts at measuring poten-evapotranspiration from a growing plant opy are valid only when water is abundant and ımited in the soil profile. Estimations of potranspiration potential from mean tempera-and energy budget data are discussed. In iarid and arid regions the actual evapotrans-ıtion is determined by the amount of precipita-. Analysis shows that use of a method for esti-ing potential evapotranspiration based on the ın temperature will result in no great difference ween the moist and the dry climates at similar latitudes and elevation. Movement toward warmer or cooler climates results in rapid changes of potential evapotranspiration. When high levels of soil moisture are maintained through irrigation, the actual evapotranspiration is nearly equal to the potential evapotranspiration. Potential evapotranspiration is discussed in relation to irrigation problems. (Sherbrooke-Ariz)
W69-08310

WATERSHED THERMAL CLIMATES AND WATER LOSS PREDICTION,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
M. T. Chang, and R. Lee.
Institute for Research on Land and Water Resources, Research Project Technical Completion Report, University Park, Pa., June 1969. 101 p, 24 fig, 24 tab, 54 ref. OWRR A-012-PA.

Descriptors: *Phenology, *Evapotranspiration, Temperature, Climatology, Energy budget, Hydrologic budget, Water yield, Transpiration.
Identifiers: *Temperature measurement, *Pallmann method, Thornthwaite method, Central Pennsylvania.

The Pallmann method of temperature sensing was to obtain space- and time-integrated air temperatures on a 303-acre experimental, forested watershed in central Pennsylvania. The method proved to be a highly sensitive, effective, and economical means of mass-sampling in complex terrain. The field precision was 0.02C, and unit sensor cost was about 15 cents. Watershed thermal climates were correlated with potential direct solar radiation and plant response trends. The season of water use, or elapsed time between leafing-out and leaf coloration, varied systematically with slope zones in the watershed. Climatological data obtained from the most convenient sampling point on the watershed were inadequate as a basis for climatological water balance estimates. Estimates were improved when chemically derived mean basin temperatures were used in conjunction with detailed soils information and plant response data. (Sink-Penn State Univ)
W69-08378

ESTIMATING FORCED EVAPORATION FROM COOLING PONDS,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 05C.
W69-08414

THE RESPONSE OF WATER TEMPERATURES TO METEOROLOGICAL CONDITIONS,
Vanderbilt Univ., Nashville, Tenn.; Office of the Surgeon General (Army) (South Vietnam); and Johns Hopkins Univ., Baltimore, Md.
For primary bibliographic entry see Field 01A.
W69-08417

A PRACTICAL FIELD TECHNIQUE FOR MEASURING RESERVOIR EVAPORATION UTILIZING MASS - TRANSFER THEORY,
Geological Survey, Washington, D. C.
G. Earl Harbeck, Jr.
Geological Survey Professional Paper 272-E, p 100-105, United States Government Printing Office, Washington, 1962. 6 p, 3 fig, 5 ref.

Descriptors: *Evaporation, *Energy budget, *Mass transfer, Wind velocity, Vapor pressure, Viscosity, Meteorological data, Seepage.
Identifiers: Lake Hefner study, Lake Mead study, Evaporation-seepage method.

Studies of evaporation made in recent years have provided values of the mass-transfer coefficient, N, in the equation E= Nu2 (eo - ea) for reservoirs having surface areas ranging from 1 to nearly 30,000 acres. The apparent correlation of N with reservoir surface area may in large part be associated with variations in the shape of the wind profile near the surface resulting from differences in surface roughness. It appears that evaporation from many reservoirs can be determined with acceptable accuracy with a fairly simple system of instrumentation, data processing, and analysis. (Sherman-Vanderbilt)
W69-08418

SOIL MOISTURE REGIME EFFECT ON YIELD AND EVAPOTRANSPIRATION FROM WARM SEASON PERENNIAL FORAGE SPECIES,
Agricultural Research Service, Thorsby, Ala. Soil and Water Conservation Research Div.; and Alabama Agricultural Experiment Station, Auburn.
Basil D. Doss, O. L. Bennett, D. A. Ashley, and H. A. Weaver.
Agronomy Journal, Vol 54, p 239-242, 1962. 4 p, 2 fig, 5 tables, 9 ref.

Descriptors: *Soil moisture, Irrigation, Evapotranspiration.
Identifiers: Greenville fine sandy loam, Moisture extractions.

Average yields of warm seasonal perennial forage species increased as soil moisture increased for all species except sericea which yielded highest at the intermediate moisture regime. Total water used depended more upon the amount of available water in the soil than on plant species. Moisture was first extracted at a shallow depth beneath the plant, and then at successively lower depths. (Bennett-USDA Agricultural Research Service)
W69-08426

EFFECTS OF SOIL MOISTURE REGIME ON YIELD AND EVAPOTRANSPIRATION FROM COOL-SEASON PERENNIAL FORAGE SPECIES,
Agricultural Research Service, Thorsby, Ala. Soil and Water Conservation Research Div.; and Alabama Agricultural Experiment Station, Auburn.
O. L. Bennett, and B. D. Doss.
Agronomy Journal, Vol 55, p 275-278, 1963. 4 p, 3 fig, 4 tables, 9 ref.

Descriptors: *Soil moisture, Evapotranspiration, Irrigation.
Identifiers: *Moisture variables, *Greenville fine sandy loam, Moisture extraction.

All species showed an increase in yield up to the intermediate moisture regime. Water was used by all species in proportion to the amounts available for evapotranspiration. Soil moisture was first extracted near the surface and at successively lower depths as soil moisture tension increased near the surface. (Bennett-USDA Agricultural Research Service)
W69-08427

EVAPOTRANSPIRATION BY IRRIGATED CORN,
Agricultural Research Service, Thorsby, Ala. Soil and Water Conservation Research Div.; and Alabama Agricultural Experiment Station, Auburn.
B. D. Doss, O. L. Bennett, and D. A. Ashley.
Agronomy Journal, Vol 54, p 497-498, 1962. 2 p, 3 fig, 1 table, 7 ref.

Descriptors: *Evapotranspiration, *Soil moisture, Pan evaporation.
Identifiers: Moisture extraction patterns, Greenville fine sandy loam.

Evapotranspiration by irrigated corn in Alabama increased with plant development to a maximum of 0.30 inch per day at dough stage and afterwards decreased with physiological activity of the plant. The ratio of evapotranspiration by corn to open pan evaporation by corn to open pan evaporation varied from 0.38 at emergence to 1.12 during early dough stage, then declined to 0.95 at grain maturity. (Bennett-USDA Agricultural Research Service)

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W69-08428

EFFECTS OF SOIL MOISTURE REGIME ON YIELD, NUTRIENT CONTENT, AND EVAPOTRANSPIRATION OF THREE ANNUAL FORAGE SPECIES,
Agricultural Research Service, Thorsby, Ala. Soil and Water Conservation Research Div.; and Alabama Agricultural Experiment Station, Auburn.
O. L. Bennett, B. D. Doss, D. A. Ashley, V. J. Kilmer, and E. C. Richardson.
Agronomy Journal, Vol 56, pp 195-198, 1964. 4 p, 3 fig, 5 tables, 5 ref.

Descriptors: *Soil moisture, *Water use, Evapotranspiration, Irrigation.
Identifiers: *Nutrient uptake, Greenville fine sandy loam.

Yields of Sudangrass, Starr millet, and Sart Sorghum and evapotranspiration rates increased as available soil moisture level increased. Sart Sorghum produced highest yield at all three moisture regimes. In general, nitrogen and potassium concentrations in plant tissue decreased with increasing soil moisture, but total uptake was usually higher with irrigation. (Bennett-USDA Agricultural Research Service)
W69-08429

EFFECT OF MOISTURE REGIME AND STAGE OF PLANT GROWTH ON MOISTURE USE BY COTTON,
Agricultural Research Service, Thorsby, Ala. Soil and Water Conservation Research Div.; and Alabama Agricultural Experiment Station, Auburn.
B. D. Doss, D. A. Ashley, and O. L. Bennett.
Soil Science, Vol 98, No 3, pp 156-161, Sept, 1964. 6 p, 4 fig, 1 table, 10 ref.

Descriptors: *Irrigation, Moisture use, Moisture content.
Identifiers: Climatic conditions, Greenville fine sandy loam.

The effect of soil moisture regime and stage of plant growth on the rate of water used by cotton was determined on a Greenville fine sandy loam at Thorsby, Alabama, during the 1958 and 1959 growing seasons. Three soil moisture regimes were established: (a) no irrigation, (b) irrigated when 80 per cent and (c) 30 per cent of the available soil moisture had been removed from the surface 24 inches of soil. Soil fertility was maintained at a high level at all soil moisture regimes. The rate of moisture used was dependent on available soil moisture and stage of plant growth. Rate of moisture use increased as the amount of available soil moisture increased. The average rate was generally low in the spring while the plants were small, gradually increased until a maximum rate was reached during the period of blooming and boll development, and then gradually decreased until bolls opened. Maximum moisture-use rates ranged as high as 0.35 inch per day with average daily rates ranging from 0.11 to 0.24 inch, depending upon period of growth and soil moisture regime. (Bennett-USDA Agricultural Research Service)
W69-08430

MOISTURE USE BY VARIOUS PLANT SPECIES AND ITS RELATION TO PAN EVAPORATION AND NET RADIATION,
Agricultural Research Service, Thorsby, Ala. Soil and Water Conservation Research Div.; and Alabama Agricultural Experiment Station, Auburn.
B. D. Doss, O. L. Bennett, and D. A. Ashley.
ARS Bulletin 41-112, Aug, 1965. 16 p, 7 fig, 5 tables, 16 ref.

Descriptors: *Moisture use, Evapotranspiration, Climate, Pan evaporation, Air temperature, Rainfall.
Identifiers: *Net radiation, Radiant energy, Greenville fine sandy loam.

Moisture use rates by 15 plant species were determined on a Greenville fine sandy loam soil at Thorsby, Alabama, during 1956 to 1962. Average daily moisture-use rates (ET) ranged from 0.03 to 0.24 inch, depending on season of year, available soil moisture, stage of plant growth, and species. In general, moisture-use rates were highest for cultivated crops and lowest for cool season perennial grasses. Moisture-use rates of species with similar seasonal growth characteristics differed little within a group, i.e., cultivated crops, warm season perennial, forages, cool season perennial legumes, and cool season perennial grasses. Moisture-use rates for 10-day periods determined from gravimetric soil sampling at 3- to 5-day intervals throughout the growing season for each species at each soil moisture regime were correlated separately with open pan evaporation and the inches of moisture equivalent of net radiation, assuming a constant value for heat of evaporization. These relations indicate that either open pan evaporation or net radiation may be used to estimate moisture use under conditions where moisture is not limiting, provided a relation has been established for the given species. To estimate moisture use on a daily basis, the appropriate ET/E or ET/Rn ratio is multiplied by the measured daily pan evaporation or inches moisture equivalent of net radiation. (Bennett-USDA Agricultural Research Service)
W69-08431

MOISTURE USE BY FORAGE SPECIES AS RELATED TO PAN EVAPORATION AND NET RADIATION,
Agricultural Research Service, Thorsby, Ala. Soil and Water Conservation Research Div.; and Alabama Agricultural Experiment Station, Auburn.
For primary bibliographic entry see Field 02I.
W69-08432

EVAPOTRANSPIRATION AT A WYOMING MOUNTAIN BOG,
Forest Service (USDA), Laramie, Wyo. Rocky Mountain Forest and Range Experiment Station.
David L. Sturges.
J Soil and Water Conserv, 1968, 23 (1): 23-25, Illus.

Descriptors: *Evapotranspiration, *Bogs, *Evaporation pans, Phreatophytes, Consumptive use, Fen, Wyoming.
Identifiers: Potential evapotranspiration.

Computed potential evapotranspiration and pan evaporation were compared during three, 5-day intervals spaced through the growing season at a mountain bog in Wyoming's Medicine Bow Mountains. Pan evaporation was also compared with actual bog evapotranspiration on 6 days during a single growing season. Evaporation from a 6-foot diameter sunken pan averaged 0.144 inch per day. Potential evapotranspiration was calculated from a graphical solution of Penman's equation and averaged 0.100 inch per day. A prediction equation for computing potential evapotranspiration from daily pan evaporation was developed. Actual bog evapotranspiration was measured in bottomless caissons either 39 or 72 inches in diameter operated with the water table at the peat surface. Pan evaporation averaged 0.104 inch on the 6 days while bog evapotranspiration was 27 percent greater or 0.132 inch.
W69-08458

MOISTURE LOSS AND WEIGHT OF THE FOREST FLOOR UNDER POLE-SIZE PONDEROSA PINE STANDS,
Forest Service (USDA), Albuquerque, N. Mex. Rocky Mountain Forest and RangeExperiment Station.
For primary bibliographic entry see Field 02G.
W69-08461

SUMMER WATER USE BY ASPEN, SPRUC AND GRASSLAND IN WESTERN COLORAD
Forest Service (USDA), Tempe, Ariz. Ro Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 02I.
W69-08468

WATERSHED TREATMENT EFFECTS EVAPOTRANSPIRATION,
Forest Service (USDA), Fort Collins, Colo. Ro Mountain Forest and Range Experiment Station.
B. C. Goodell.
In Sopper, Wm. E., and Lull, H. W. (ed). Int Sy Forest Hydrol Proc 1967: 477-482.

Descriptors: *Watershed manageme *Evapotranspiration, *Forest management, In ception, Transpiration, Evaporation, Cano *Water yield improvement, Water utilizati Hydrologic cycle, Snow management, Ene budget.

Watershed evapotranspiration depends on the s tial and temporal confluence of water and ther energy at watershed surfaces. Four categories surfaces may exist: (1) external surfaces of lea and plant stems, (2) internal plant surfaces, (3) surface, (4) snowpack surface. Water becon present on these surfaces through interception precipitation, absorption and transport of water by plants, capillary flow of soil water, and snow accumulation. Generally, radiant energy the main source of the heat of vaporization. any mass of vegetation per unit of land ar evapotranspiration should be maximum when pl substance is most uniformly distributed through the growing space. Interception of precipitati and radiation, and transport of soil water to tra piring surfaces are then maximum. Forest mani lation, such as partial clearing, caus heterogeneity in canopy and root distribut should minimize evapotranspiration. To be eff tive, persistent discontinuities must be produce the canopy and/or root network. Substitution vegetation of shallower root and/or canopy de longer dormant season, or lower transpiration ra are other means by which watershed managem can reduce evapotranspiration.
W69-08481

SURFACE RESISTANCE OF CROP CANOPIE
Rothamsted Experimental Station, Harpen (England).
G. Szeicz, and I. F. Long.
Water Resources Res, Vol 5, No 3, p 622-633, Ju 1969. 12 p, 7 fig, 3 tab, 28 ref.

Descriptors: *Evapotranspiration, *Transpirati Mathematical models, Diffusion, Dispersion, T bulence, Air circulation, Energy budget, Resp tion, Stomata, Photosynthesis, Moisture tens Temperature.
Identifiers: Stomatal resistance.

Three analytic and 2 empiric methods described to calculate the surface resistance crops transpiring at a measured rate. The pro method is applicable when detailed temperatu humidity, and wind profiles are measured; for residual method, measurements of surface t perature, wind, and humidity are enough; for heat balance method, the calculation is based the ratio of potential to actual evaporation rough estimates, an empiric equation of Montt or a relation between leaf area and surface sistance can be used. In southern England and California all 3 analytic methods agree clos Hourly values of surface resistance in Califor demonstrate the effect of water stress on an rigated grass canopy by midday, whereas in gland the surface resistance of a barley crop is c stant for almost the whole day. From Aslyng's m surements of evaporation, the relation of surf resistance to soil-water potential is calculate show how relative rates of transpiration photosynthesis may change in response to w stress. For an equatorial rain forest in Kenya, m

nthly surface resistance varied systematically
n soil moisture deficit, ranging between 0.3 and
sec per cm. (Knapp-USGS)
9-08573

. Streamflow and Runoff

EORETICAL STREAM LENGTHS AND AINAGE AREAS IN HORTON NETS OF RIOUS ORDERS,
ois Univ., Urbana; and Illinois Univ., Champ-gn.
primary bibliographic entry see Field 07A.
9-08211

SSISSIPPI WATER RESOURCE CONRENCE - 1969.
ssissippi State Univ., State College. Water ources Research Inst.

est, Melville S., Chairman. Proc Miss State Univ ter Resources Res Inst Conf, Apr 8-9, 1969. 169

scriptors: *Water resources development, iver basin development, *Mississippi River, ississippi, Sedimentology, Sedimentation, Pesti-es, Dams, River training, Forestry, Eutrophica-n, Eonomics, Navigation, Floods, Conferences. ntifiers: Conference Proceedings.

cent water resources studies in Mississippi were cussed in a conference held in Jackson, Apr. 8-1969. The subjects of the papers included in the oceedings include port development, shipping ntainerization, corrosion control, industrial elopment, forestry, eutrophication, pesticides, iment sampling, sedimentation, river basin nning, floods, economics of water resource velopment, Mississippi River patamology, and all dam design. (See also W69-08222 and W69-223). (Knapp-USGS)
59-08221

OOD PLAIN INFORMATION OF BARDEN EEK, CASPER, WYOMING-VOLUME 1.
rps of Engineers, Omaha, Nebr.
r primary bibliographic entry see Field 04A.
69-08224

ME REMARKS ON THE USE OF DIGITAL MPUTERS AND HYDRAULIC METHODS R FLOOD ROUTING AND FLOOD RECASTING PROBLEMS,
itute of Hydrotechnical Research, Bucharest umania).
Amaftiesei, and F. Ionescu.
np on Use of Analog and Digital Computers on lrol, Tucson, Ariz, Dec 1968, Int Ass Sci lrol, Pub No 80, Vol 1, pp 189-197, 1968. 9 p, 7 3 ref.

scriptors: *Mathematical models, *Computer dels, *Flood routing, *Digital computers, lrographs, Stage-discharge relations, River casting, Flood forecasting, Streamflow casting, Water management (Applied). ntifiers: Romania, Rating curves.

ne applications of digital computers in solving d routing and flood forecasting problems are ented. To reproduce the phenomenon of a d wave propagation in an open channel, a hematical model based on a finite difference me for numerical integration of Saint Venant's ations is used; in this model boundary condis such as those given by tributaries, lateral harges or local head losses, can easily be inuced. A mathematical model was used in the of the Danube and Prut Rivers with embanked nels. The possibilities and conditions to simplihe equations are discussed. The use of the nematical model for a short time forecast of a d wave propagation on the lower stretch of ube is outlined. Difficulties arise in the case of untrained river channels with wide flood plains; attempts to solve them are discussed. (Knapp-USGS)
W69-08232

HYPOTHETICAL FLOOD COMPUTATION FOR A STREAM SYSTEM,
Corps of Engineers, Sacramento, Calif. Hydrologic Engineering Center.
For primary bibliographic entry see Field 07C.
W69-08239

APPLICATION OF COMPUTERIZED OPERATIONS RESEARCH TECHNIQUE FOR OPTIMUM ECONOMIC SIZING OF THE MIDDLE FORK EEL RIVER PROJECT,
California State Dept. of Water Resources. Advanced Techniques Section.
For primary bibliographic entry see Field 06A.
W69-08240

SOME PROBLEMS OF STREAMFLOW FORECASTS BASED ON INFORMATION THEORY,
Research Inst. for Water Resources Development, Budapest (Hungary).
K. Body, G. Erdos, and K. Szesztay.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Int Ass Sci Hydrol, Pub No 80, Vol 1, pp 280-288, 1968. 9 p, 7 fig.

Descriptors: *Streamflow forecasting, *Routing, *Discharge (Water), Stage-discharge relations, Computer programs, Digital computers, Streamflow, Stream gages, Statistical methods.
Identifiers: River travel times, Information theory.

Regularities of the streamflow regime of a river system may be described by relations between the discharges of selected gaging stations. On the basis of data of 17 stations for about 2000 days, analyzed by digital computer systems, stage-discharge relations were determined to forecast discharges of the Danube River at the Iron-Gate section for 5 and 10 day periods. Travel times may be determined even under conditions of backwater effect. Utilizing the new possibilities offered by the computers, special forecast equations have been established for each day on the basis of the data most characteristic of the streamflow regime conditions of the given day. (Knapp-USGS)
W69-08241

OPERATIONAL STREAMFLOW FORECASTING WITH THE SSARR MODEL,
Weather Bureau, Portland, Oreg. River Forecast Center.
Vali P. Schermerhorn, and Donald W. Kuehl.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Int Ass Sci Hydrol, Pub No 80, Vol 1, pp 317-328, 1968. 12 p, 7 fig, 10 ref.

Descriptors: *Streamflow forecasting, *Computer models, *Computer programs, *Mathematical models, Rainfall-runoff relationships, Snowpacks, Snowmelt, Precipitation (Atmospheric), Synthetic hydrology, Hydrograph analysis, Flood forecasting, Routing, Systems analysis.
Identifiers: River basin simulation, SSARR model.

The Streamflow Synthesis and Reservoir Regulation (SSARR) Model and the associated computer program and its application to headwater basin runoff simulation are described. The complete model was developed to synthesize the response of a complex river system to the input of precipitation and temperature plus the regulation by man-made structures. An alternate multi-zone mode of basin runoff computation provides snow accounting by subareas of the basin. An approach to adjustment of internal computation to observed conditions is presented. (Knapp-USGS)
W69-08245

APPLICATION OF STREAMFLOW SYNTHESIS AND RESERVOIR REGULATION--'SSARR'--PROGRAM TO THE LOWER MEKONG RIVER,
Corps of Engineers, Portland, Oreg. North Pacific Div.
David M. Rockwood.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Int Ass Sci Hydrol, Pub No 80, Vol 1, pp 329-344, 1968. 16 p, 4 fig, 6 ref.

Descriptors: *Streamflow forecasting, *Computer models, *Computer programs, *Mathematical models, Rainfall-runoff relationships, Routing, Synthetic hydrology, River forecasting, Hydrograph analysis, Flood forecasting, Systems analysis, Reservoir operations, Regulation.
Identifiers: Mekong River.

The application of the Streamflow Synthesis and Reservoir Regulation (SSARR) model to the Mekong River is described. Computed and observed hydrographs were compared and show that the model can provide accurate forecasts, even in basisn with as few rain and stream gages as the Mekong. (Knapp-USGS)
W69-08246

FLOOD PLAIN INFORMATION OF NORTH FORK OBION RIVER, HOOSIER AND GROVE CREEKS, UNION CITY, TENNESSEE.
Corps of Engineers Memphis, Tenn.
For primary bibliographic entry see Field 04A.
W69-08247

LAG TIME OF NATURAL CATCHMENTS,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
Arthur J. Askew.
New South Wales Univ Water Res Lab Rep No 107, July 1968. 209 p, 42 fig, 10 tab, 52 ref, 5 append.

Descriptors: *Rainfall-runoff relationships, *Routing, *Runoff forecasting, *Mathematical models, *Computer programs, Hydrographs, Hyetographs, Hydrograph analysis, Synthetic hydrology.
Identifiers: Lag computation (Runoff).

An investigation was made of the values of lag time for natural catchment areas, as measured from center of mass of excess-rainfall to center of mass of resulting runoff. Any variation in this value for an individual catchment is an indication of a nonlinear response. Values of lag were measured for a range of floods on 5 catchment areas. The difference in value between catchments was found to be a function of the catchments' characteristics, while variation in the values for an individual catchment was strongly related to the magnitude of the floods. As the degree of this variation was fairly constant for the areas studied, the degree of nonlinearity was also considered to differ little between the catchments. The development of 3 general formulae required a detailed analysis to be made of a large volume of hydrologic data by an objective systematic procedure. For this purpose lag was measured to the center of mass of direct runoff and a weighted mean discharge measure of flood magnitude was devised. Numerous hyetograph characteristics were measured and studied, but none appeared to have any significant influence on the value of lag time. Computer program listings for computing lag-discharge relationships and for regression analysis of lag-discharge relationships are included. (Knapp-USGS)
W69-08250

AN OUTLINE OF POLAND'S HYDROGRAPHY (POLISH),
Warsaw Univ. (Poland). Faculty of Biology; Warsaw Univ. (Poland). Faculty of Geography; and Warsaw Univ. (Poland). Faculty of Geophysics.
For primary bibliographic entry see Field 02A.
W69-08253

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DROUGHTS IN FINNISH WATERCOURSES WITH REFERENCE TO WATER SUPPLY AND POLLUTION CONTROL (FINNISH),
Finnish Hydrological Office, Helsinki.
Eero Kajosaari.
Helsinki, Painovalmiste, 1968. 118 p, 24 fig, 12 tab, 91 ref.

Descriptors: *Drought, *Streamflow forecasting, Streamflow, River regulation, Water storage, Lakes, Statistical methods, Duration curves, Hydrographs, Frequency analysis, Water management (Applied).
Identifiers: *Finland.

Droughts and water-supply problems in Finland are discussed from the point of view of water supply and hydroelectric power management. A drought is defined as a period longer than 6 months with a mean runoff less than the mean runoff of the entire period of record of the watercourse. The 17 analyzed watercourses are unregulated. Dry periods of 5, 15, 31, 61, 91, 121, and 151 days were analyzed by digital computer. To describe numerically the characteristics of dry periods, the concept of specific deficit was used. It is the hypothetical storage volume per unit of catchment area required to maintain runoff equal to the long-term mean runoff during periods of droughts. Increasing catchment size and increasing lake influence diminish the difference between long-term and short-term drought runoff, but have no effect on relative drought severity. The results of frequency analysis are used to estimate long-term safe yield. (Knapp-USGS)
W69-08254

GEOHYDROLOGIC SUMMARY OF THE PEARL RIVER BASIN, MISSISSIPPI AND LOUISIANA,
Geological Survey, Jackson, Miss.
For primary bibliographic entry see Field 02F.
W69-08264

EFFECT OF HEAVY LATE-FALL PRECIPITATION ON RUNOFF FROM A CHAPARRAL WATERSHED,
Rocky Mountain Forest and Range Experiment Station.
Paul A. Ingebo.
USDA Forest Service, Research Note RM-132. 2 p, 1969, 2 fig.

Descriptors: *Rainfall-runoff relationships, *Water storage, *Arizona, Arid lands, Chaparral, Demonstration watersheds, Water balance, Storm runoff, Rainfall, Streamflow, Time log, Hydrologic budget, Flow characteristics, Hydrologic equation, Regulated flow, Water yield, Recharge, Overburden.

Nov/Dec precipitation in 1965 at Three Bar experimental watershed, Arizona, measured 24.29 in., about 7 times the preceeding 9-yr. average. Streamflow during this period was 2.4 area-inches. A water balance equation indicated a 19.9 in. increase in stored water. Streamflow responded little to the 8 in. of rainfall in Nov., presumably because of soil-water deficits. But, with additional precipitation in early Dec. streamflow responded markedly, even though storage also increased. The uniform rate of streamflow (during most of Dec.) compared to the more sporadic rainfall suggests a continuing buffering action in movement of water through the watershed. A recession-type flow continued until mid-Jan. and is thought to have extended through the period of light spring rains. Rational solution of the water balance equation necessitates recognition of the storage potential within the watershed. This storage potential is a peculiarity of the regolith; thus, the depth and characteristics of the overburden appear to be important considerations in studying water yields, storage, and flow behavior of watersheds. (Sherbrooke-Ariz)
W69-08285

STREAMFLOW - AN IMPORTANT FACTOR IN FOREST MANAGEMENT IN THE COASTAL PLAIN,
Forest Service (USDA), Charleston, S. C. Southeastern Forest Experiment Station.
Cortland E. Young, Jr.
South Lumberman 215 (2680):109-110, Dec 1967. 2 p, 2 fig.

Descriptors: *Streamflow, *Forest management, *Storm runoff, *Design criteria, Drainage, Bridges, Atlantic Coastal Plain, Wetlands, Forests, Water resources, Low flow, Weirs.

This paper discusses the importance of streamflow to the forest manager in the lower coastal plain and presents an example of streamflow behavior from a forested watershed. Streamflow data are needed to aid in drainage system and bridge designs and water resource development. Streamflow records to date indicate that the amount of stormflow produced from a lower coastal plain watershed is highly dependent on the storage potential of the watershed prior to rainfall. On the average this watershed produces more stormflow than forested watersheds in the mountains and Piedmont; however, streamflow from our watershed is intermittent with no flow periods as long as 1 to 2 months occurring each year.
W69-08439

AREAL EXTENT OF SNOW COVER IN RELATION TO STREAMFLOW IN CENTRAL COLORADO,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 02C.
W69-08454

STREAMFLOW VOLUMES AND HYDROGRAPHS BY FLUORESCENT DYES,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 07B.
W69-08480

FORECASTS WITH VARYING RELIABILITY,
Harvard Univ., Cambridge, Mass.
Myron B. Fiering.
Proc, Amer Soc Civil Eng, Vol 95, No SA3, p 629-644, June 1969. 16 p, 2 tab.

Descriptors: *Streamflow forecasting, *Variability, *Mathematical models, *Optimization, *Design, Systems analysis, Water resources, Monte Carlo Method, Operations, Reliability, Computers.

An application of computing and systems analysis techniques to water resources design was made. The objective of the study was to combine the selection of components, the specification of optimal operating policies and the role of streamflow forecasting in a single mathematical entity. No formalism for forecasting was given, but based on a model for flow sequences, a technique was developed by which the analyst could discern whether or not it was useful to include forecasting in the operating policy. The procedure made use of statistical theory and the Monte Carlo Method. Subsequent work particularly that which involved mathematical programming offered new insights into the construction of optimal operating schemes. By means of regression analysis it was possible to construct operating rules which explicitly accommodated flow forecasts of different reliability. (Thiuri-Cornell)
W69-08545

RANDOM WALK AND RANDOM ROUGHNESS MODELS OF DRAINAGE NETWORKS,
Technion - Israel Inst. of Tech., Haifa. Dept. of Agricultural Engineering.
Ido Seginer.
Water Resources Res, Vol 5, No 3, p 591-607, June 1969. 17 p, 11 fig, 2 tab, 18 ref.

Descriptors: *Drainage patterns (Geologic *Topography, *Statistical models, Stochast processes, Probability, Monte Carlo metho Streams, Drainage systems, Watersheds (Basins).
Identifiers: Drainage geometry, Topographi roughness, Random walk method.

A random walk model of a drainage network generated on an underlying matrix by selecting random the drainage direction out of the element ry areas. In a random roughness model, roughne heights of the elementary areas rather tha drainage directions are assigned at random. Th resulting topography of that model then unique determines the drainage pattern. An equivalence the 2 models is suggested by the similarities foun in the mode of construction and by the equality the probabilities of occurrence of some simple co figurations. The random roughness model can yie values of primary probabilities, i.e., probabilitie which can be used in the construction of a rando walk model. The various types of drainage patter are classified by the sets of primary probabilitie which would generate them. Thus outcomes homogeneous and isotropic matrices are classifie as pure dendritic patterns. Outcomes of homogene ous matrices with probability sets derived from sloping plane roughness model are classified general dendritic (including parallel) pattern Trellis, annular, and other patterns are considere as subgroups of the class of patterns generated all other possible matrices. (Knapp-USGS)
W69-08571

ONE-DIMENSIONAL EQUATIONS OF OPEN CHANNEL FLOW,
California Univ., Davis. Dept. of Water Scienc and Engineering.
Theodor Strelkoff.
ASCE Proc, J Hydraul Div, Vol 95, No HY3, Pa 6557, pp 861-876, May 1969. 16 p, 3 fig, 23 re append.

Descriptors: *Open channel flow, *Equations *Mathematical models, Unsteady flow, Wave (Water), Reynolds number, Turbulence, Stress Discharge (Water), Streamflow, Viscosity, Shear
Identifiers: St. Venant equations.

One-dimensional equations of continuity, momen tum, and energy for unsteady, spatially varied flo in a fixed-bed open channel of arbitrary configura tion are derived from the point forms of the co responding hydrodynamic equations by integratin the latter over a deforming region of space com prising a slice of differential thickness across th flow with a top always coincident with the fluctuat ing water surface. To bring the equations to th form of Saint Venant in fixed and accelerating reference frames, departures from hydrostati pressure conditions in a cross section due to latera acceleration, viscous deformation, and turbulen Reynolds stresses are reproduced exactly; the rat of energy dissipation in a cross section is uniquel related to wall shear over the wetted perimeter; th term accounting for lateral discharge depends upo its nature; bulk outflow is considered. (Knapp USGS)
W69-08589

PROPAGATION OF FLOOD WAVES IN OPEN CHANNELS,
Minnesota Univ., Minneapolis. St. Anthony Fall Hydraulic Lab.
Bahram Mozyeny, and Charles S. Song
ASCE Proc, J Hydraul Div, Vol 95, No HY3, Pa 6561, pp 877-892, May 1969. 16 p, 15 fig, 13 ref append.

Descriptors: *Flood routing, *Open channel flow *Waves (Water), *Unsteady flow, Equations Mathematical models, Digital computers, Floods Flood forecasting, Model studies.
Identifiers: Method of characteristics.

Using the method of characteristics, the equation of motion and continuity were numerically solve for the case of a sinusoidal flood wave in a lon

ngular open channel. The effects of various neters, such as the friction coefficient, slope, ce of propagation, initial amplitude of the wave, etc., on the damping of the flood wave studies. It was revealed that the maximum nsionless discharge and depth are exponential ons of the distance traveled. An empirical la relating the damping coefficient and other arameters was drived. A light nonlinear rela- ip between the initial flood amplitude and t a downstream section was noted. (Knapp- S)
08590

EMATIC VARIATION PATTERN OF AN- L RIVER FLOWS,
burne Univ., Parkville (Australia). Dept. of eering; and Scott and Furphy, Melbourne ralia).
W. F. Waitt, and Ian C. O'Neill.
Proc, J Hydraul Div, Vol 95, No HY3, Pap p 787-809, May 1969. 23 p, 4 fig, 8 tab, 17 ppend.

iptors: *Streamflow, *Statistical methods, elation analysis, *Variability, Regression sis, Streamflow forecasting, Hydrographs, collections, Probability, Water level fluctua- Rainfall-runoff relationships.
fiers: Streamflow variability.

tical analysis of annual river flows in the d States, some European countries and ern Australia, in latitudes higher than 34 deg. S indicates a useful significant relationship en the standard deviation of the logarithms of s depth of annual runoff from a river ment and the geometric mean annual runoff . For the separate zones, equations and tables ven for the evaluation of probabilities of an- flow of a river from its estimated geometric depth of annual runoff and these can be used e records are inadequate or as a check on methods. The logarithmic distribution was to be appropriate for statistical analysis, with eral trend towards slight negative skewness. of a small sample suggest that dry season may follow a similar pattern to that of the an- lows. (Knapp-USGS)
08591

ERSION OF SILT PARTICLES IN OPEN NNEL FLOW,
Univ., Iowa City. Inst. of Hydraulic Research.
rimary bibliographic entry see Field 02J.
08592

OD PLAIN INFORMATION NEUSE AND NT RIVERS AND JACK SMITH CREEK, BERN, NORTH CAROLINA.
s of Engineers, Wilmington, N. C.
rimary bibliographic entry see Field 04A.
08593

ER RESOURCES AND DEVELOPMENT: ER RESOURCES,
gical Survey, Portland, Oreg.
Phillips.
ral and Water Resources of Oregon, Dept of or Rep for Comm on Interior and Insular Af- p 325-369, 1969. 45 p, 13 fig, 13 tab, 55 ref.

iptors: *Water resources, *Oregon, *Surface s, *Groundwater, Streamflow, Aquifers, r supply, Water utilization, Water quality, r yield, Water management (Applied), logic data, Data collections.

n has a large supply of water, but it is nly distributed with respect to both area and Floods and shortages of water are frequent. climate of the western third of Oregon is cterized by moderate temperatures, wet win- and dry summers; about 78% of the annual pitation occurs in the period October to March. The eastern 2/3 of the State has greater extremes of temperature but less seasonal variation in precipitation; about 65% of the precipitation occurs in the period October to March. The average annual precipitation ranges from about 200 in. at places in the Coast and Cascade Ranges to less than 10 in. in parts of north-central and southeast Oregon. The statewide average is about 27 in. per yr. Flooding and drought are due to natural causes and have been alleviated in some areas by storage, drainage, diking, and irrigation. In some places groundwater is too highly mineralized for most uses. Repeated use of water for irrigation tends to increase the concentration of dissolved minerals. Nutrients stimulate undesirable algal growths in rivers and lakes. Municipal and industrial wastes at times deplete the natural supply of dissolved oxygen in streams and thus block the passage of migrant anadromous fish. One of the most difficult problems is to balance the divergent interest of those who recognize the growing needs for use and control of the State's water supplies. Streamflow and groundwater availability in Oregon's rivers and groundwater basins are summarized and the data are tabulated. (USGS)
W69-08604

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 6. MISSOURI RIVER BASIN.
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07C.
W69-08605

FLOOD PLAIN INFORMATION, TIDAL LANDS OF CAPE MAY COUNTY, NEW JERSEY.
Corps of Engineers, Philadelphia, Pa.
For primary bibliographic entry see Field 04A.
W69-08609

FLOOD PLAIN INFORMATION, UPHAM BROOK, HENRICO, VIRGINIA.
Corps of Engineers, Norfolk, Va.
For primary bibliographic entry see Field 04A.
W69-08610

GAMMA CORRELATION AND ITS USE IN COMPUTATIONS OF LONG-TERM STREAMFLOW REGULATION,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 07C.
W69-08612

USE OF DIGITAL COMPUTERS FOR MATHEMATICAL MODELLING OF HYDROLOGICAL PROCESSES,
Gruzinskii Politekhnicheskii Institut, Tiflis (USSR).
For primary bibliographic entry see Field 07C.
W69-08624

THEORY OF STOCHASTIC PROCESSES IN HYDROLOGY AND RIVER RUNOFF REGULATION,
N. A. Kartvelishvili.
Transl from Gidrometeorologicheskoe Izdatel'stvo, Leningrad, 1967. 223 p, 79 fig, 4 tab, 97 ref, 7 append. Available from Clearinghouse as TT-68-50478 at $3.00 in paper copy and $0.65 in microfiche.

Descriptors: *Statistical methods, *Stochastic processes, *Streamflow forecasting, *River regulation, Markov processes, Synthetic hydrology, Runoff forecasting, River forecasting, Reservoir operation, Water management (Applied).
Identifiers: USSR.

The annual volumes of river runoff constitute a sequency of random variables. In studies of runoff regulation, there is a tendency to replace the theory of random events with the theory of stochastic processes, using the analysis of alternation of runoff volumes during high and low water phases and correlating runoff between contiguous time intervals. The literature of stochastic hydrology is surveyed, summarized, and presented systematically in a form intended to aid in further research and development of the techniques of using stochastic methods in river management, but not as a textbook or manual for computations. The principal aim is to help develop methods for reducing stochastic problems to algorithmic form for computer processing, and to apply the stochastic method to regulation. No advanced or specialized mathematical background is necessary for comprehension of the book, but a good general knowledge is required. A bibliography of the basic work in the field is included. (Knapp-USGS)
W69-08626

2F. Groundwater

CALIFORNIA'S DIGITAL COMPUTER APPROACH TO GROUNDWATER BASIN MANAGEMENT STUDIES,
California State Dept. of Water Resources.
For primary bibliographic entry see Field 04B.
W69-08235

PREPARATION, VERIFICATION AND USE OF A DIGITAL GROUNDWATER SIMULATION PROGRAM,
General Electric Co., Santa Barbara, Calif. TEMPO.
For primary bibliographic entry see Field 07C.
W69-08236

GROUND WATER RESOURCES IN THE KOCHI PLAIN, SOUTHWEST JAPAN (JAPANESE),
Industrial Science and Technology Agency, Kawasaki (Japan). Geological Survey.
S. Takahashi, and S. Nagai.
Bull Geol Surv of Japan, Vol 19, No 10, pp 13-29, Oct 1968. 17 p, 19 fig, 2 tab, 5 ref.

Descriptors: *Aquifers, *Water resources, *River basins, Water supply, Artesian wells, Water table, Subsidence, Earthquakes, Salinity, Chlorides, Streamflow, Water resources development.
Identifiers: *Japan, Kochi Plain (Southwest Japan).

Groundwater resources of the Kagami, Kokubu, and Monobe river basins of southwest Japan were studied with regard to geohydrological conditions. Withdrawals total about 51,100 cubic meter per day, of which 21,900 cu m is artesian water and 29,200 is from water table aquifers. Recharge of the artesian aquifers in the Kokubu River estuary area is from streamflow of Kokubu and Kagami Rivers. It is of interest that this area is characterized by land subsidence cause by a strong earthquake in 1946 and since that time contamination of the groundwater has increased, reaching 5000-15,000 ppm of chlorine. In general, the Monobe River basin can be considered as having good possibility for the further development of groundwater resources in the Kochi plain. (Gabriel-USGS)
W69-08248

GEOHYDROLOGIC SUMMARY OF THE PEARL RIVER BASIN, MISSISSIPPI AND LOUISIANA,
Geological Survey, Jackson, Miss.
L. W. Lang.
Geol Surv Open-file Rep, 1967. 44 p, 10 fig, 2 plate, 4 tab, 41 ref.

Descriptors: *Water resources, *Geohydrologic units, *Streamflow, *Surface-groundwater relationships, *Mississippi, Aquifers, Appraisals, Environment effects, Rainfall disposition, Water quality, Water users, Saline water, Estuaries, Low flow, Storage capacity, River basins.
Identifiers: *Pearl River basins, Potential water sources, Low flow yields.

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The environmental framework of the 8,760 sq mi Pearl River basin, Mississippi and Louisiana, is described and appraised as to the quantity and quality of available water by basin segments both in aquifer units and a streamflow. The report discusses present use of the aquifers and surface waters, relationship of groundwater to streamflow, aquifer and well characteristics, and potential sources of supply including saline water as a resource. An annotated bibliography of 41 selected reports is included. Fresh groundwater occurs from the surface to depths ranging from sea level in the upper basin segment to more than 3,000 ft. below sea level in the lower segments; a total of 3 billion ac ft of water is in aquifer storage. Of the average annual rainfall on the river basin (26 million acre ft), about 9 mil ac ft is recoverable from aquifers and streamflow for water supply. Low flow yields vary from 0.20 cu ft/sec per square mile of drainage area in a reach of the basin underlain by permeable sandy deposits to 0.05 cfs per sq mi of drainage area where the basin is formed in clay, marl, and finer sands. Wells with pumping rates of 500 to 1,000 gpm are common basinwide, and some deep wells in the central lowlands flow at rates up to 3,500 gpm. Nearly all the groundwater in the 6 or more major aquifer systems is of good to excellent quality, and streamflow is even less mineralized (median dissloved solids 50 ppm or less at 10 sites in the basin). The basin estuary is a potential source of freshwater (less than 1,000 ppm dissolved solids) to moderately saline water (3,000 to 10,000 ppm) that will require special planning and management for many uses. (Lang-USGS)
W69-08264

SATURATED THICKNESS AND SPECIFIC YIELD OF CENOZOIC DEPOSITS IN KANSAS,
Geological Survey, Lawrence, Kans.; and Kansas State Geological Survey, Lawrence.

Kans State Geol Surv Map No M-5, 1967. 1 sheet.
Bayne, Charles K.; Ward, John R., Compilers.

Descriptors: *Groundwater, *Aquifers, *Kansas, *Cenozoic era, Specific yield, Zone of saturation, Water yield, Water wells.
Identifiers: Cenozoic aquifers (Kansas).

The saturated thicknesses and specific yields of Cenozoic deposits in Kansas are shown on a map scaled 1:500,000. (Knapp-USGS)
W69-08265

TRACING GROUNDWATER WITH CHLORIDE IONS AND TRITIUM THROUGH ACID KAOLINITIC SOIL,
Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
J. C. Corey, and J. W. Fenimore.
Intern'l Journ. Appl. Radiation and Isotopes, Vol 19, No 10, pp 741-746, 1968. 5 p, 4 fig, 13 ref.

Descriptors: *Groundwater movement, *Radioactive tracers, *Acidic soils, Aquifers, Retention, Kaolinite, Heavy water, Chlorides, Ions, Soil water movement, Arid climates, Wet climates.

Recent investigations with chloride ions in soils from arid regions concluded that chlorides are equal or preferable to tritium as groundwater tracers. These soils are normally neutral to basic, and do not retain anions. The present study utilized acid kaolinitic clays, from regions of abundant rainfall. It demonstrates that the breakthrough for chloride was retarded more than that for tritium, indicating interaction of chloride ions with acid soils. Thus chloride and other negatively charged ions, which may be preferable in many arid regions, have limited usefulness as water tracers in acid soils. (Sherbrooke-Ariz)
W69-08286

GEOLOGY AND GROUNDWATER OCCURRENCE IN SOUTHEASTERN McKINLEY COUNTY, NEW MEXICO,
Geological Survey, Washington, D. C.
James B. Cooper, and Edward C. John.
New Mexico State Engineer, Tech Rept No 35, 1968. 108 p, 7 fig, 2 pl, 5 tab, 58 ref.

Descriptors: *New Mexico, *Groundwater, Semiarid climate, Uranium Radioisotope, Radioactivity, Aquifer characteristics, Artesian well, Deep wells, Depth, Geologic formations, Groundwater mining, Groundwater recharge, Hydrogeology, Transmissivity, Underground storage, Water table, Water chemistry, Shallow wells.
Identifiers: McKinley Co., New Mexico.

This semiarid area of about 1,300 sq. mi. is topographically diverse, without perennial streams or large permanent bodies of surface water. Groundwater, commonly under artesian pressure, is yielded to wells from at least 16 distinct aquifers. Yields of 300 g.p.m. or more are obtained from wells that tap the aquifer in the Glorieta Sandstone and San Andres Limestone. The other aquifers commonly yield only 5 to 30 g.p.m. Well depth ranges from 20 ft. to more than 1,200 ft., while water levels range from above surface to about 800 ft. below. Water quality varies widely, but most groundwater is chemically suitable for stock and domestic use. Most aquifers receive only scant recharge directly from precipitation because their outcrop areas are small. In most of the area withdrawals are minimized by the dominance of ranching. Since 1951 mining of uranium ore and related groundwater withdrawal in the Ambrosia Lake and Smith Lake areas has created widespread interest in the occurrence, control, and disposal of groundwater. Water associated with uranium deposits is slightly radioactive. The availability, quantity and quality of groundwater are related to the geologic regimen. (Sherbrooke-Ariz)
W69-08287

GROUNDWATER RESOURCES OF UPTON COUNTY, TEXAS,
Geological Survey, Washington, D. C.
D. E. White.
Texas Water Develop Bd, Rept 78, May, 1968. 132 p, 21 fig, 7 tab, 42 ref.

Descriptors: *Water resources, *Texas, Arid lands, Aquifer characteristics, Depth, Discharge, Geologic formations, Groundwater mining, Groundwater recharge, Hydrogeology, Hydrologic aspects, Observtion wells, Overdraft, Transmissivity, Underground forage, groundwater movement, Water table, Water sources, Water supply, Topography, Drainage, Geohydrologic units, quifers, Water chemistry, Brine disposal, Sulfates, Fluorides, Dissolved solids.
Identifiers: *Upton Co.

Upton County, in western Texas, is semiarid in climate, with a high rate of evaporation and occasional years of rainfall as low as 6 inches or less annually. The county's groundwater resources are insufficient to furnish all the water needs of cities, industries, irrigation and livestock; consequently, water is imported from adjoining counties. Increased utilization of the Trinity Sand aquifer is resulting in an acceleration of the rate of water-level decline and a concomitant decrease in yields. New large-scale development should be located in new areas and wider spacing of wells and smaller yields should be considered. Chemical analysis shows that few of the Trinity Sand wells meet the standards of the U. S. Public Health Service, the sulfate, fluoride and dissolved-solids concentrations being too high. The present study yielded evidence that some of the wells have been contaminated, presumably from the disposal of oil-field brines into unlined surface pits. A network of 6 observation wells has been established. (Sherbrooke-Ariz)
W69-08288

THE CONTROL OF GROUNDWATER OCCURRENCE BY LITHOFACIES IN THE GUADALUPIAN REEF COMPLEX NEAR CARLSBAD, NEW MEXICO,
Massachusetts Univ., Amherst.
For primary bibliographic entry see Field 04B.
W69-08294

GROUNDWATER POTENTIAL OF KA AQUIFERS IN SAUDI ARABIA,
Ministry of Agriculture and Water, Riyadh (S Arabia); and Food and Agriculture Organizatio the United Nations, Rome (Italy).
David J. Burdon, and Galip Otkun.
Internat'l Assoc Hydrogeol, Congress of Istan 1967, Memoir 8, pp 165-176, 1968. 12 p, 2 f tab, 14 ref.

Descriptors: *Karst, Water resources developm Ions, Arid lands, Water chemistry, Aquifer cha teristics, Carbonate rocks, Geologic formati Sandstones, Sulfates, Water sources.
Identifiers: *Saudi Arabia.

The purpose of this paper is to draw attentio the groundwater potential of the karst aquife Saudi Arabia before the sandstone aquifers proach full development. The discussion of ge hydrogeological conditions includes details of bonate and sulfate formations. Karst formation preservation is considered in relation to (1) space and openings in carbonate rocks, development of joints and fissures, (3) enlarge of openings, joints and fissures, (4) marine ero of karst surfaces, and (5) infilling of karst openi Data are presented on water chemistry. Man the carbonate waters are acceptable for most poses, while the sulfate waters (where free chloride additions) would generally be accept for irrigation uses. On the basis of location, geol cal history, stage of present development and ture development potential, these karst aquifers divided into 3 groups for discussion. The karsti aquifers may in the long run prove as valu water producers in Saudi Arabia as the sandst aquifers. (Sherbrooke-Ariz)
W69-08296

THE APPLICATION OF GEOELECTRIC METHODS FOR GROUND-WATER EXPLO TION OF UNCONSOLIDATED FORMATIC IN SEMI-ARID AREAS,
Zagreb Univ. (Yugoslavia). Geophysical Inst.
For primary bibliographic entry see Field 07B.
W69-08297

GROUND WATER OF THE WESTERN DESE IN IRAQ,
Baghdad Univ. (Iraq). Dept. of Geology.
For primary bibliographic entry see Field 03C.
W69-08298

WATER RESOURCES INVESTIGATION IN SEMIARID BASIN IN ARIZONA, U.S.A.,
Geological Survey, Tucson, Ariz. Water Resou Div.
E. S. Davidson.
Internat'l Assoc Hydrogeol, Congress of Istan 1967, Memoir 8, pp 552-558, 1968. 7 p, 4 fig.

Descriptors: *Analog models, *Water ta *Arizona, Arid lands, Discharge (Water), F measurement, Groundwater movement, Riverfl Aquifer characteristics, Natural recharge, Tr missivity, Underground storage, Water qua Estimating, Water supply, Analog computers.
Identifiers: *Tucson basin.

This paper describes a water-resources study of Tucson basin in terms of hydrologic data availa new data collected, and analysis of the hydrol system utilizing a groundwater analog model. study was prompted by concern over declin groundwater levels, as much as 60 ft. since 19 Water utilization was 55% irrigation, 35% dome and public supplies, and 10% industrial sup More than 1000 wells were studied to obtain on aquifer transmissibility, tracing and evalua of individual aquifers and correlation of aqui with rock units. Streamflow records were availa and were programmed for a computer. All stre in the Tucson basin have a very large stand deviation of annual flow. Analog-computed wa levels for 1940 closely resembled actual data. W adjustment the analog-model balancing will ef

ly measure annual recharge. The discharge is wn or can be projected, and the model will pro- approximate water levels that may be expected ne future. Estimates indicate that groundwater ed in the Tucson basin is very large in relation resent annual pumpage. (Sherbrooke-Ariz)
9-08299

ESTIGATION OF THE GEOCHEMISTRY WATER IN A SEMIARID BASIN ARIZONA,
A.,
ological Survey, Tucson, Ariz. Water Resources

.. Laney.
rnat'l Assoc Hydrogeol, Congress of Istanbul, 7, Memoir 8, pp 559-565, 1968. 7 p, 3 figs, 1

criptors: *Geochemistry, *Arizona, Ground- er basins, Arid lands, Aquifer characteristics, ter chemistry, Solutes, Geohydrologic units, lerground streams, Ion exchange, Bicarbonates, cium, Calcium sulfate, Chlorides, Fluorides, ium sulfate, Sodium, Groundwater movements, colating water, Drainage effects, Hydrogeology. ntifiers: *Tucson basin.

undwater in the Tucson basin was divided into en chemical types on the basis of relative ounts of calcium, sodium, bicarbonate, and ate and the absolute amount of chloride. The er types were related to geohydrologic environ- nts. Groundwater was of suitable chemical lity for most industrial, domestic, and irrigation s, but in places the dissolved-solids content and ride exceeded optimum concentrations. Water lity varies with depth, but the variation was not form throughout the basin. The chemical com- ition of groundwater was altered by deposits hin 1 to 3 mi. of the recharge areas. Changes in chemical composition of water during the nsition from rainwater to groundwater depended the relative similarity between dissolved com- nds and the mineralogical composition of the These changes were traced for the different re- ns of the basin and include a four step process in northeast section. Ion exchange and reactions ted to lithification and cementation of deposits y have modified the composition of ground- er. (Sherbrooke-Ariz)
9-08300

DENTIFICATION OF AQUIFER PARAME- RS BY DECOMPOSITION AND MUL- EVEL OPTIMIZATION,
ifornia Univ., Los Angeles. Dept. of Engineer-

Y. Haimes, R. L. Perrine, and D. A. Wismer.
ter Resources Center, Univ of Calif, Contrib, 123, p 1-53, March 1968. 53 p, 4 tab, 9 fig, 34

criptors: *Optimization, *Aquifers, *Water nagement (Applied), *Boundaries (Surfaces), ansmissivity, *Storage, Wells, Pressure, Esti- ing, Digital computer, Systems analysis, Flow. ntifiers: Decomposition, Multilevel optimization niques.

omposition and multilevel optimization niques were applied to the identification of smissivity, storage and boundary configuration meters characterizing flow of an aquifer. The was to find the simplest efficient methods of ting optimal estimates for the aquifer parame- The use of these values would, in turn, permit best predictions to be made regarding aquifer onse to any demand. A multiple well system formulated for any integral number of produc- wells. Pressure observation and production data utilized for optimal estimation of parameters. different techniques, the gradient method and direct-search, were utilized for optimization of irst level. The Gauss-Spidel algorithm was util- for the optimization of the second level. A well system was introduced for an example its parameters determined using a digital com- r. (Thiuri-Cornell)

W69-08550

EFFECT OF SEDIMENT CONCENTRATION ON WELL RECHARGE IN A FINE SAND AQUIFER,
Texas A and M Univ., College Station; and Florida Univ., Gainesville.
Md. Ataur Rahman, Ernest T. Smerdon, and Edward A. Hiler.
Water Resources Res, Vol 5, No 3, p 641-646, June 1969. 6 p, 7 fig, 2 tab, 6 ref.

Descriptors: *Recharge wells, *Sedimentation, Clays, Model studies, Hydraulic models, Filtration, Sands, Permeability, Porosity, Hydraulic conductivity, Aquifers.
Identifiers: Well-filter clogging, Formation clogging, Aquifer testing.

A model recharge well was constructed to simulate recharge into wells in a fine sand aquifer. The sand in the model aquifer was uniform fine sand and had a uniformity coefficient of 1.25 and an effective diameter of 144 microns. Both clear tap water and sediment-laden water were used for recharge. Sediment-laden water was obtained by mixing 50% bentonite and 50% kaolinite with tap water. Sediment concentrations were 100, 200, and 500 ppm. The piezometric surfaces near the recharge well were measured during the tests. Migration of sediment into the aquifer was determined by sampling the aquifer sand after the tests at predetermined distances from the well. The sediment in the recharge water highly affected the rate of recharge. During the period of the tests a reduction in hydraulic conductivity of the model aquifer of 15-46% occurred as a result of recharge with sediment-laden water. Most of the sediment deposited in the aquifer was retained near the well screen. (Knapp-USGS)
W69-08574

SIMILARITY APPROXIMATION FOR THE RADIAL SUBSURFACE FLOW PROBLEM,
Drexel Inst. of Tech., Philadelphia, Pa.
R. L. Drake, F. J. Molz, Irwin Remson, and A. A. Fungaroli.
Water Resources Res, Vol 5, No 3, pp 673-684, June 1969. 12 p, 3 fig, 1 tab, 12 ref.

Descriptors: *Mathematical models, *Mathematical studies, *Approximation method, *Groundwater movement, Flow, Porous media, Saturated flow, Unsaturated flow, Synthetic hydrology, Simulation analysis, Computer programs, Digital computers.
Identifiers: *Similarity approximation, Radial groundwater flow.

A useful mathematical technique in the study of radial flow of underground water is the application of similarity transformations, such as Boltzmann's transformation. The transformations lead to approximations that are shown to be valid if certain physical parameters satisfy given limiting conditions. A nonlinear partial differential equation is formulated describing the radial flow of soil moisture. A similarity approximation is used to transform the partial differential equation into a nonlinear ordinary differential equation. Criteria by which to judge the applicability of the similarity approximation are derived. Several monotonicity properties of the transformed moisture as a function of the similarity variable are derived. The properties are used to develop numeric procedure for the solution of the transformed equation. The procedure is used to study the radial flow of soil moisture to a cylindric sink for diffusivities which vary linearly, quadratically, and exponentially with soil moisture. The solutions show that the moisture front steepens with increasing nonlinearity. (Knapp-USGS)
W69-08575

TWO-DIMENSIONAL SEEPAGE OF BONDED WATER TO FULL DITCH DRAINS,
Iowa State Univ., Ames. Dept. of Agronomy.
A. W. Warrick, and Don Kirkham.
Water Resources Res, Vol 5, No 3, pp 685-693, June 1969. 9 p, 4 fig, 8 ref. Grant No WP-00070-05 (PHS).

Descriptors: *Drainage systems, *Ditches, *Seepage, *Mathematical models, Synthetic hydrology, Drainage engineering, Dewatering, Hydraulic conductivity, Anisotropy, Soils, Soil water movement, Groundwater movement.
Identifiers: Nomogram.

Seepage of ponded water to full, equally spaced ditch drains is analyzed mathematically, considering 4 distinct cases. In the first case, an impermeable soil barrier is present at a finite depth, and the ditches are a finite distance apart; in the second case, no impermeable soil barrier is present, and the ditches are a finite distance apart; in the third case, an impermeable barrier is present, but the ditches are in effect an infinite distance apart; and in the fourth case, no impermeable barrier is present, and the ditches are in effect an infinite distance apart. The ditches may penetrate part or all of the way to an impermeable barrier. Schwartz-Christoffel transformations are used to solve the first case. Solutions for the other 3 cases are found by taking limiting values of the first case. Flow nets illustrate the results. In one calculated example, the flow rate without an impermeable barrier is 10% greater than when an impermeable barrier exists at a depth of 0.2 times the ditch semispacing. The flow nets illustrate the rapid decrease in surface water intake at increasing distances from the ditch. A nomogram gives seepage rates when no impermeable barrier is present and infinitely wide spacing is used. An illustration shows that the nomograph is useful to estimate seepage rates for flow media of finite depth and width. (Knapp-USGS)
W69-08576

WATER LEVELS IN OBSERVATION WELLS IN NEBRASKA--1968,
Nebraska Univ., Lincoln. Conservation and Survey Div.; and Geological Survey, Lincoln, Nebr.
C. F. Keech, and G. R. Svoboda.
Nebr Water Survey Pap No 24, June 1969. 43 p, 7 fig, 1 tab, 15 ref.

Descriptors: *Groundwater, *Water levels, *Observation wells, *Nebraska, *Data collections, Hydrologic data, Hydrographs, Water-level fluctuations.
Identifiers: *Periodic observations.

Water level data from the Nebraska observation well network for 1968 are tabulated. Hydrographs and contour maps show water levels and fluctuations. Each well record shows location, period of record, water levels, and change in water levels. Most of the measurements were made in the Fall, after the close of the irrigation season. (Knapp-USGS)
W69-08588

GEOLOGY AND HYDROLOGY OF THE PROJECT RULISON EXPLORATORY HOLE, GARFIELD COUNTY, COLORADO,
Geological Survey, Denver, Colo.
Paul T. Voegeli, Sr.
Geol Surv Open-file Rep, Apr 4, 1969. 17 p, 4 fig, 4 tab, 1 ref. Contract No AT (29-2)-474 (AEC).

Descriptors: *Hydrogeology, *Water wells, *Aquifers, *Colorado, Water yield, Transmissivity, Permeability, Water levels, Groundwater basins, Discharge (Water).
Identifiers: *Garfield County (Colo), *Test holes, Drillstem tests, Aquifer testing.

Hydrologic tests on the Rulison exploratory hole, Garfield County, Colo., indicated that little or no water occurs in the Ohio Creek Conglomerate and Mesaverde Group which are the stratigraphic units most likely to yield water to the hole. Six depth intervals, beginning at 6,129 ft and ending at 8,018 ft, were tested. Pressures recorded during the testing

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of the individual zones indicated little or no fluid entry while the test tool was open. (USGS)
W69-08596

WATER RESOURCES AND DEVELOPMENT: WATER RESOURCES,
Geological Survey, Portland, Oreg.
For primary bibliographic entry see Field 02E.
W69-08604

2G. Water in Soils

SOIL SLIPS RELATED TO VEGETATION, TOPOGRAPHY, AND SOIL IN SOUTHERN CALIFORNIA,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
R. M. Rice, E. S. Corbett, and R. G. Bailey.
Water Resources Res, Vol 5, No 3, pp 647-659, June 1969. 13 p, 1 fig, 7 tab, 18 ref.

Descriptors: *Mass wasting, *Soil-water-plant relationships, Landslides, Saturation, Hydraulic conductivity, Soil texture, Vegetation, Topography, Soil conservation, Soil mechanics.
Identifiers: *San Dimas Experimental Forest (Calif), Soil slips.

Soil slippage, a form of shallow mass soil movement, was studied on the San Dimas Experimental Forest in southern California after several large storms in 1965 and 1966. The 3-part study consisted of analyzing topographic data from 200 random points measured photogrammetrically; measuring soil texture, soil depth, wettability of surface soil, and hydraulic conductivity of slip surface on slipped and stabel sites; and mapping and analyzing soil slips to assess the effects of watershed variables. All slips occurred on slopes greater than 80%. The occurrence of slips was inversely related to the size and density of vegetation. In brush areas, northerly aspects were more stable than southerly ones. Conversion from brush to grass on the experimental forest may have resulted in an additional 135 cu m/ha of soil slip erosion during the winter of 1965-1966. (Knapp-USGS)
W69-08201

THE VERTICAL MOVEMENT OF WATER IN STRATIFIED POROUS MATERIAL. 2. TRANSIENT STAGES OF DRAINAGE TO A WATER TABLE,
Cambridge Univ. (England). School of Agriculture.
M. Bybordi.
Water Resources Res, Vol 5, No 3, pp 694-697, June 1969. 4 p, 1 fig, 1 tab, 4 ref.

Descriptors: *Infiltration, *Seepage, *Percolation, Saturated flow, Unsaturated flow, Wetting, Submergence, Hydraulic conductivity, Soil water movement, Water yield, Model studies, Hydraulic models, Mathematical studies, Water table.
Identifiers: Vertical soil water flow.

An equation is derived using the Green and Ampt concept to describe the yield of water at a given time from a freely draining composite column of initially saturated porous materials in a gravitational field. The equation is supported by experimental results. The agreement between computed and observed curves of drainage from composited columns is fairly satisfactory but not as good as in the case of infiltration. The reason is in part because the shape of the moisture profile for drainage is less abrupt than for infiltration, so that the condition for the validity of the Green and Ampt approximation is not so well satisfied. At the same time the less well defined water front introduces greater experimental uncertainties. The air entry pressure exhibits hysteresis and is greater for drying than for wetting; during wetting the whole pore space must be filled from dryness to saturation, whereas drainage releases only a portion. When the coarser sand is at the bottom the water front comes to rest in a lower position than when the finer sand is below the coarser. (Knapp-USGS)
W69-08203

ON THE SOLUTION OF THE PROBLEMS OF INFILTRATION WITH THE AID OF ELECTRONIC COMPUTERS (FRENCH),
Institute of Hydrotechnical Research, Bucharest (Rumania).
Vitalie Pietraru.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Int Ass Sci Hydrol, Pub No 80, Vol 1, pp 175-188, 1968. 13 p, 7 fig, 2 tab, 8 ref.

Descriptors: *Mathematical models, *Seepage, *Surface-groundwater relationships, *Digital computers, Numerical analysis, Groundwater movement, Darcy's law, Flow nets, Synthetic hydrology, Analog models.
Identifiers: Romania.

New digital computers can be used for solution of complicated seepage problems by means of numerical methods. Investigations in progress by several research workers from various countries have not been generally successful in spite of several satisfactory results obtained so far. Assuming Darcy's law is valid, the study of groundwater motion through homogeneous and isotropic permeable media consists in a single integration, known as the relaxation and overrelaxation method. The optimal overrelaxation coefficient was determined taking into account Young and Thirriot's investigations. The boundary conditions are described as well as the rational computation schemes adequate for several problems in seepage through homogeneous media. The results are given as spectra of equipotential and flow lines. A comparison of the results obtained from numerical computation on digital computers with the results provided by electric analog models shows that the analogs are still advantageous in the case of homogeneous media with simple boundary conditions. Numerical methods should substitute gradually for the conventional techniques now in use (analytical, analog, graphical, and physical models). (Knapp-USGS)
W69-08231

TRACING GROUNDWATER WITH CHLORIDE IONS AND TRITIUM THROUGH ACID KAOLINITIC SOIL,
Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
For primary bibliographic entry see Field 02F.
W69-08286

WATER RELEASE AS A SOIL PROPERTY RELATING TO USE OF WATER BY PLANTS,
California Univ., Riverside.
For primary bibliographic entry see Field 03F.
W69-08302

FOREST DRAINAGE RESEARCH IN THE COASTAL PLAIN,
Forest Service (USDA), Charleston, S. C. Southeastern Forest Experiment Station.
For primary bibliographic entry see Field 04A.
W69-08437

WATER TABLE, SOIL MOISTURE, AND OXYGEN DIFFUSION RELATIONSHIPS ON TWO DRAINED WETLAND FOREST SITES,
Forest Service (USDA), Charleston, S. C. Southeastern Forest Experiment Station.
For primary bibliographic entry see Field 04A.
W69-08443

HYDROLOGIC PROPERTIES OF PEAT FROM A WYOMING MOUNTAIN BOG,
Forest Service (USDA), Laramie, Wyo. Rocky Mountain Forest and Range Experiment Station.
David L. Sturges.
Soil sci, 1968, 106 (4): 262-264, Illus.

Descriptors: *Hydrologic properties, *
*Water storage, *Moisture tension, *Bulk de
*Hydraulic conductivity, Fen, Bobs, Wyoming
Identifiers: Histosols.

Selected hydrologic characteristics of peat fr
Wyoming mountain bog were measured i
laboratory and in the field. Sample depths we
13 and 13-25 cm. in moderately decomposed
face peat, and 36-48 cm. in decomposed peat.
densities were 0.160, 0.208, 0.216, g/cc. at
depths, respectively. Water yields at these re
tive depths were 0.223, 0.140, and 0.076 c
between saturation and 0.10 bar suction,
0.500, 0.458, and 0.349 cc./cc. between satur
and 1.00 bar suction. Both bulk density and
retention were related to the degree of decom
tion and thus to pore size distribution. Surface
contained large voids which emptied at low
tions, but greater suctions were required to
the smaller pores of decomposed material. Hy
lic conductivity measured in situ at depths
and 91 cm. was 23.9 x 10-3 and 16.1 x 10-3 cm
day, respectively.
W69-08456

**SOIL MOISTURE RESPONSE TO SPRAY
BIG SAGEBRUSH WITH 2, 4-D,**
Forest Service (USDA), Laramie, Wyo. R
Mountain Forest and Range Experiment Statio
For primary bibliographic entry see Field 02I.
W69-08460

**MOISTURE LOSS AND WEIGHT OF
FOREST FLOOR UNDER POLE-SIZE
DEROSA PINE STANDS,**
Forest Service (USDA), Albuquerque, N.
Rocky Mountain Forest and RangeExperimen
tion.
Earl F. Aldon.
Journal of Forestry, 66 (1): 70-71.

Descriptors: *Forest soils, Humus, Conife
forests, Soil moisture, *Moisture deficit, W
loss, *Ponderosa pine trees.
Identifiers: *Forest floor, Litter weight, Moi
loss.

Between 0.16 and 1.09 inches of moisture were
from the forest floor on plots of pole-size
derosa pine during part of the summer
dershower period in Arizona. This represent
loss of from 7 to 27 percent of gross precipita
Stand age offered a good estimate of weight o
forest floor on these plots.
W69-08461

**DETRIMENTAL EFFECT OF RUSSIANT
TLE ON SEMIDESERT RANGE IN WEST-C
TRAL NEW MEXICO,**
Forest Service (USDA), Albuquerque, N.
Rocky Mountain Forest and Range Experi
Station.
Earl F. Aldon.
US Forest Serv Res Note RM-109. 2 p.

Descriptors: *Plant growth, Vegetation eff
Grasses, *Ranges, *Land management, *W
*Grasslands.
Identifiers: Ground cover.

Ground cover of perennial grasses declined
ously under plots covered overwinter with
thistle plants. Adjusted means of ground cove
100 feet of line intercept showed the control
5.16 feet and plots where thistle was held
winter 2.81 feet. This difference is significant a
5% level
W69-08464

DUCTION CAPABILITIES OF SOME ER RIO PUERCO SOILS OF NEW MEX-
st Service (USDA), Albuquerque, N. Mex.
ky Mountain Forest and Range Experiment on.
. Campbell.
Forest Serv Res Note RM-108. 7 p.

criptors: *Soils, Ranges, Grasses, Barley, *Soil sture, *Soil science, Soil texture, *Soil-water- t relations.
tifiers: Ground cover.

ability of plant cover on the Rio Puerco rshed within short distances is thought to be primarily to availability of water. Even though eight soils sampled varied from native to cul- ed lands, from fine sands to firm clays, and river bottoms to high plateaus, they were nor- in moisture-holding capacity, pH, and other ical and chemical characteristics.
-08465

ECT OF GRAZING ON INFILTRATION IN ESTERN WATERSHED,
st Service (USDA), Tempe, Ariz. Rocky ntain Forest and Range Experiment Station.
primary bibliographic entry see Field 04D.
-08479

ISTURE-RETENTION CAPACITY OF TER UNDER TWO ARIZONA CHAPARRAL MUNITIES,
st Service (USDA), Tempe, Ariz. Rocky ntain Forest and Range Experiment Station.
Garcia, and C. P. Pase.
A Forest Serv Res Note RM-85, 2 p, illus.

riptors: *Chaparral, *Soil moisture, *Shrubs, logy, *Soil-water-plant relationships, Canopy. tifiers: *Litter, *Plant-water relations, Live Manzanita.

er-holding capacity of Pringle manzanita litter aged 5.1 m., and shrub live oak litter 4.8 mm., r dense, uniform canopies. Pringle manzanita held more water per gram of litter than did live oak (2.00 vs. 1.80), but total litter uced was less (11.2 tons per acre vs. 12.1).
-08488

NFALL AND STREAMFLOW FROM LL TREE-COVERED AND FERN- ERED AND BURNED WATERSHEDS IN AII,
st Service (USDA), Berkeley, Calif. Pacific hwest Forest and Range Experiment Station.
Anderson, P. D. Duffy, and Teruo amoto.
orest Service Research Paper PSW-34 (1967):

riptors: *Rainfall-runoff relations, *Peak arges, *Storm runoff, *Hydrologic properties, ershed management, *Burning, Reforesta- Ferns, Trees, Analytical techniques, Hawaii. ifiers: Principal components analysis.

mflow from two 30-acre watersheds near olulu was studied by using principal com- nts regression analysis. Models using data on hly, storm, and peak discharges were tested st several variables expressing amount and in- y of rainfall, and against variables expressing edent rainfall. Explained variation ranged 78 to 94 percent. The analysis provided some as to the dominant hydrologic processes three different watershed conditions. The of change in the coefficients relating precipita- o runoff in the pre- and post-fire periods may terpreted as indicating that the burning of the shed had little effect on the infiltration or per- ng capacity--at least not in the range such as ect rainfall excess or storm interflow or both. On the other hand, the increase in the regression constant indicates that the burning of the watershed had its expected effect in reducing any storage that was readily available for evaporation, such as the interception storage.
W69-08510

SURFACE SOIL TEXTURE AND POTENTIAL ERODIBILITY CHARACTERISTICS OF SOME SOUTHERN SIERRA-NEVADA FOREST SITES,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Donald W. Willen.
Proc Soil Sciences Soc of America, Vol 29, No 2 (1965): 213-218.

Descriptors: *Erosion, *Soil aggregates, *Cohesion, *Soil formation, *Laboratory tests, Soil sampling, Basalts, Igneous rocks, Vegetation effects, Humid climates, Mapping.
Identifiers: Erodability, Erosion ratios.

Analyses of soil texture and potential erodibility were made on 208 samples of residual upland forest soils, collected at elevations of 6500 to 8,500 ft. Multiple regression tests showed that soil texture and erodibility indices were significantly related to variation in parent rock type, vegetative cover type, aspect, slope, elevation, and their interactions. Prediction equations imply that granitic forest soils at high elevation may be twice as erodibile as soils developed under similar soil-forming conditions at low elevations. Coefficients permitting estimations of soil texture, aggregation, dispersion ratios and surface-aggregation rates are given.
W69-08513

SIMILARITY APPROXIMATION FOR THE RADIAL SUBSURFACE FLOW PROBLEM,
Drexel Inst. of Tech., Philadelphia, Pa.
For primary bibliographic entry see Field 02F.
W69-08575

2H. Lakes

DIGITAL COMPUTER APPLICATIONS TO GREAT LAKES REGULATION,
Department of Energy, Mines and Resources, Ottawa (Ontario); and McGill Univ., Montreal (Quebec).
For primary bibliographic entry see Field 07C.
W69-08242

NITROGEN FIXATION IN SOME ANOXIC LACUSTRINE ENVIRONMENTS,
Florida Univ., Gainesville. Dept. of Environmental Engineering.
Patrick L. Brezonik, and Carol L. Harper.
Science, Vol 164, pp 1277-1279, June 1969. 1 tab, 27 ref.

Descriptors: *Nitrogen fixation, *Lakes, Dystrophy, Nitrogen cycle, Eutrophication, Bacteria, Cycling nutrients, Cyanophyta, Limnology, Nitrogen compounds, Enzymes, Environmental effects, Gas chromatography, Wisconsin, Florida, Meromixis, Oxygen, Color, Temperature, Thermocline.
Identifiers: *Anoxic environments, Acetylene reduction assay, Nitrogenases, Nitrogen-15, Nostocales, Lake Mary (Wis), Vilas County (Wis), Lake Mize (Fla), Alachua County (Fla), Monomixis, Heterotrophy, Kjeldahl nitrogen, Biogeochemistry, Organic nitrogen.

Utilizing an assay for nitrogenase activity involving the reduction of acetylene to ethylene, authors studied nitrogen fixation in two dystrophic lakes: Lake Mary, Wisconsin, and Lake Mize, Florida. Following range rates of nitrogen fixation (in nanograms/liter/hour) indicate presence of nitrogenase and in situ fixation in these lakes: Lake Mary (28 June 1968), 3.3-46.6. Lake Mize (11 July 1968), 83-308; 21 August 1968, 0.0-83.3. Maximum fixation occurred in both lakes in aphotic and anoxic environment: at 20 meters in Lake Mary, and in Lake Mize at 9.1 meters in July and at 15 meters in August. Data for total Kjeldahl nitrogen by depth in both lakes (August) and for total organic nitrogen in Lake Mize (July) are also tabulated in report. Authors cite environmental conditions in these lakes as evidence that agents of fixation were probably bacteria rather than cyanophytes. It is suggested that if similar rates of fixation are widespread in anoxic lake water and lacustrine sediments, estimates of the role of fixation in global nitrogen budget will have to be increased. (Eichhorn-Wis)
W69-08280

THE 'WORKING' OF THE MADISON LAKES,
William Trelease.
Wisconsin Acad Sci, Arts and Letters, Vol 7, pp 121-129, 1889. 1 fig, 1 plate, 60 ref.

Descriptors: *Eutrophication, Cyanophyta, Odor, Scum, Fishing, Wisconsin, Bibliographies, Lakes, Nuisance algae, Bacteria, Water pollution effects.
Identifiers: *Madison (Wis), *'Working' of lakes, *Water-bloom, 'Breaking' of lakes, Chroococcaceae, Nostochineae, Clathrocystis aeruginosa, Coelosphaerium Kutzingianum, Anabaena flos aquae, Anabaena mendotae, Anabaena hassali, Lyngbya nollei, Glocotrichia pisum, Nostoc verrucosum, Lake Mendota (Wis), Lake Monona (Wis), Lake Waubesa (Wis), Anabaena circinalis.

The Madison (Wisconsin) lakes were observed for signs of eutrophication from 1882-1887. Symptoms observed included greenish-yellow scum or fine granules suspended in water, odors associated with algal decomposition, staining of shorelines, and decreased fish biting. The algae generally appeared in mid-summer and persisted for only a few days before being broken up and dispersed by breezes. Such phenomena have been referred to as the 'working' or 'breaking' of lakes and are synonymous with the European term 'water-bloom'. The symptons, caused by the occurrence of members of the algae group Cyanophyceae, are favored in stagnant water bodies and usually occur after prolonged hot spells. The two principal subdivisions of the group are Chroococcaceae and Nostochineae. Of the former, Clathrocystis aeruginosa and Coelosphaerium Kutzingianum were the principal problem species in the Madison lakes, and from the latter, Anabaena flos aquae and Anabaena circinalis were most common. Anabaena mendotae, which is more tolerant of cold, predominates late in the season. Paper includes a list of sixty references on water-blooms. Only principal papers treating recurrence of bacteria in quantity are included, most of them have little botanical value but serve as a nucleus for other references available in 1889. (Ketelle-Wis)
W69-08283

HEAT BUDGET OF AN ICE COVERED INLAND LAKE,
Wisconsin Univ., Madison. Dept. of Meteorology.
Jon T. Scott, and Robert A. Ragotzkie.
Technical Report No 6, Series to Lakes and Streams Investigations Committee, Oct 1961. 41 p, 15 fig, 13 tab, 23 ref. ONR Contract No: 1202 (07). NR 387-022.

Descriptors: *Heat budget, *Ice, *Lake, *Conduction, Heat transfer, Latent heat, Heat exchange, Radiation, Albedo, Absorption, Advection, Estimating, Air, Water, Snowcover.
Identifiers: Lake Mendota.

The heat budget for Lake Mendota is evaluated for two winter seasons. Winter is defined as extending from the time just before freezing of the lake surface until all ice has melted in the spring. Change in heat storage, radiation flux, conduction (molecular and/or eddy) and advection are determined separately for snow, ice, and water where applicable. Sensible and latent heat flux at the lake surface are not directly measured, but the heat budget

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method appears to be promising for determining at least their sum. Aerial and lake surface measurements of albedo are compared with each other and to visual estimates of albedo based on ice or snow conditions and age of the snow surface. Results indicate that visual estimates by experienced observers are reliable within 10 percent. Heat conduction in the snow-ice-complex is measured using a thermocouple and flux-plate assembly. Seven distinct periods of the winter season are described using the heat budget data for the two years. Net radiation, air temperature, and amount and type of snow cover are the most important factors affecting the heat budget of the winter lake. (Sherman-Vanderbilt)
W69-08404

SELECTIVE WITHDRAWAL FROM DENSITY - STRATIFIED RESERVOIRS,
California Inst. of Tech., Pasadena.
For primary bibliographic entry see Field 05C.
W69-08419

PRODUCTION OF JUVENILE STEELHEAD TROUT IN A FRESHWATER IMPOUNDMENT,
Oregon State Game Commission, Corvallis. research Div.
Andre G. Coche.
Ecological Monographs, Vol 37, No 3, pp 201-228, Summer 1967. 13 fig, 18 tab, 69 ref, 2 appendices, disc.

Descriptors: *Biomass, *Fish populations, *Growth rates, *Impounded waters, Food habits, Limnology, Mortality, Trout, Oregon.
Identifiers: *Net production, *Salmo gairdneri, *Steelhead trout, *Yield, Aquatic insects, Forage ration, Mortality rates, Littoral fauna, Whistler's Bend Impoundment, Oregon.

The concept of rearing steelhead trout in controlled impoundments has arisen from increasing civilization pressure on areas of natural production. Production of juvenile steelhead trout was studied in relation to temperature and food supply in a 13.3 hectare (ha) impoundment. Over 302 days (by 15-day periods), the stock of 102,000 fish showed instantaneous mortality rates, i, of 0.003-0.117 (total 0.986), total production of 619 killograms (kg) and net production (total minus mortality) of 363 kg (28 kg/ha). Fork length-weight relationship: log W= -2.07+ 3.06 log L; condition factor, K, (with standard errors indicated in parentheses) ranged from 0.89 (0.013) to 1.14 (0.033), remaining greater than 1.0 in summer and less than 1.0 in winter; peak values occurring in August. Instantaneous rate of growth in weight, g, for entire period was 3.6, 88% of this was elaborated in the summer. Trout fed mainly on benthic insects (Chironomidae, Callibaetis, Anisoptera), with crustacean zooplankton being only occasionally important. Changes in growth rate over 15-day periods appeared to be related to feeding habits rather than temperature. Tabular data include population statistics and comparisons of growth rates, production, survival, and yield obtained from several studies. (Voigtlander-Wis)
W69-08517

MORPHOMETRY AS A DOMINANT FACTOR IN THE PRODUCTIVITY OF LARGE LAKES,
Saskatchewan Univ., Saskatoon.
D. S. Rawson.
Verh int Verein theor Limnol, Vol 12, p 164-175, 1955. 5 fig, 3 tab, 15 ref, disc.

Descriptors: *Eutrophication, *Oligotrophy, *Lakes, *Lake morphology, *Productivity, Plankton, Bottom fauna, Fish production, Trophic level, Regression analysis, Estimating equations.
Identifiers: Lake depth, Deep lakes, Shallow lakes, Canada, Lake size.

A quantitative demonstration that deep lakes are usually less productive than shallow ones is provided. Mean depth, regarded as best single index to morphometric conditions, is plotted against dry weight of plankton, bottom fauna and fish production for several lakes in western and central Canada. Analysis of regression were used to produce formulas describing the theoretical relationship between mean depth to the biological parameters. Deviations of the actual amounts of these materials from those expected theoretically appear to be attributable to the modifying effects of climatic or edaphic conditions. (Bortleson-Wis)
W69-08519

STUDIES ON CONNECTICUT LAKE SEDIMENTS. II. CHEMICAL ANALYSES OF A CORE FROM LINSLEY POND, NORTH BRANFORD,
Yale Univ., New Haven, Conn. Osborn Zoological Lab.
G. E. Hutchinson, and Anne Wollack.
Amer J Sci, Vol 238, No 7, p 493-517, July 1940. 4 fig, 3 tab, 21 ref.

Descriptors: *Connecticut, *Chemical analysis, *Lakes, *Sediments, *Eutrophication, Paleolimnology, Sedimentation, Cores, Ecology, Diagenesis, Organic matter, Pollen, Phosphorus, Productivity, Inorganic compounds.
Identifiers: *Linsley Pond (Conn), Lignin, Trophic equilibrium, Glacial history, Paleoecology, North Branford.

Several inorganic and organic constituents were determined on a 43-foot core from Linsley Pond, a small eutrophic lake in Connecticut. The upper 36 feet consisted of a coarse detrital ooze, followed by a transition to a silty clay, which became dominant below 40 feet. The total ash and organic content of the sediments was very uniform throughout the consolidated ooze from 3 to 34 feet. Considerable increase in the inorganic content in the most recent unconsolidated sediment at the top of the profile is taken to indicate increased erosion of cultural origin. The distribution of organic matter in the profile is believed to indicate a rapid change from oligotrophy to eutrophy, followed by a long period of approximate equilibrium in a eutrophic condition. Several measures of organic matter in the sedimentary column were plotted according to two limiting assumptions: (1) that unit thickness of sediment was deposited in unit time, and (2) that unit mass of inorganic sediment was laid down in unit time. The time scale constructed by both methods of analysis revealed an apparent logarithmic increase in organic matter in the region between 43 and 30 feet. It is suggested that the mode of development is characteristic of a growth-curve for organisms. The nature of the trophic equilibrium is examined in relation to nitrogen and phosphorus content of the mud. (Bortleson-Wis)
W69-08521

PALEOLIMNETIC SALINITY OF DZUNGAR AND ORDOS BASINS,
Shao Hung-shuen, and Huang Ti-fan.
Int Geol Rev, Vol 11, No 4, pp 461-470, Apr 1969. 10 p, 2 fig, 4 tab, 8 ref. Transl from Acta Geol Sinica, Vol 45, No 3, pp 337-347, 1965.

Descriptors: *Paleolimnology, *Paleoclimatology, *Lakes, Water quality, Salinity, Paleohydrology, Salts, Evaporation, Water chemistry, Chlorides.
Identifiers: *Paleosalinity, *China, Dzungar, Ordos.

Among geochemical methods available for determination of salinity of paleo water basins, the chlorine-content method, chloro-bromine coefficient method, and salinity coefficient method are considered most effective. The boundary between fresh water and brackish water sediments is marked when the chlorine content of mudstone is 0.02% and the chlorine-bromine coefficient 20 (salinity coefficient being around 1.5); the boundary between brackish and semi-saline sedimentation is recognized when they reach respectively to 0.12-0.15% and 80. Some Dzungar paleo lacustrine basins, during the period from Late Permian to Middle and Early Triassic age had been fille fresh water at the earlier stage, with brackish during the intervening and later stages. salinization cycles show correlation with the tion of the paleo climate. The evolution of sa tent in the paleo lakes of Ordos is quite di from Dzungar lakes. They were of fresh wat ing the Permian and middle Early Triassic, b ing the Early Permian the water was relativel and became somewhat fresh thereafter. Ther together two fresh cycles. The difference in tion of water properties of these 2 lake ba considered to be the logical consequence o respective actual geological environment a confinement of the lake basins. (Knapp-USG
W69-08594

2I. Water in Plants

EFFECTS OF EXTERNAL SALT CONCEN TIONS ON WATER RELATIONS IN PL IV. THE COMPENSATION OF OSMOTIC HYDROSTATIC WATER POTENTIAL FERENCES BETWEEN ROOT XYLEM EXTERNAL MEDIUM,
California Univ., Riverside. Dept. of Soils and Nutrition.
J. J. Oertli, and W. F. Richardson.
Soil Sci, Vol 105, No 3, pp 177-183, 1968. fig, 10 ref.

Descriptors: *Salinity, *Osmotic pressure, *H static pressure, Circulation (Plants), physiology, Transpiration, Moisture u Microenvironment, Soil-water-plant relatio Irrigation effects, Root zone, Zylem.

Experiments on sunflower plants and tomato show that variations of the osmotic potenti ference between root xylem and external m are nearly compensated for by variations hydrostatic potential difference, so that the stays nearly independent of external-solutio centrations having osmotic potentials of 0 bars. Increasing salt concentrations only a this relationship slightly, while reducing tran tion rates substantially. This absence of p tionality between transpiration rate chang change in the net osmotic-hydrostatic potenti ferences is probably the result of a solute ac lation at the root surface and in the root free Other explanations include change of root pe bility for water, due to the salinity, or syste error in experimental procedures. (Sherbr Ariz)
W69-08291

STOMATAL INFILTRATION MEASUREM AS AN INDICATOR OF THE W REQUIREMENT AND TIMING OF IR TION FOR COTTON,
National and Univ. Inst. of Agriculture, Reh (Israel).
For primary bibliographic entry see Field 03F
W69-08293

WATER ECONOMY OF AGAVE SISA UNDER DESERT CONDITIONS,
National Research Centre, Cairo (Egypt).
For primary bibliographic entry see Field 03F
W69-08303

FOREST SITE AMELIORATION IN COASTAL FLATWOODS OF MISSISSIPPI.
Mississippi State Univ., State College. Sch Forest Resources.
For primary bibliographic entry see Field 04A
W69-08397

EFFECT OF SOIL MOISTURE LEVE ROOT DISTRIBUTION OF COOL-SE FORAGE SPECIES,
Agricultural Research Service, Thorsby, Ala and Water Conservation Research Div

ma Agricultural Experiment Station, Au-

. Bennett, and Basil D. Doss.
ony Journal, Vol 52, p 204-207, 1960. 4 p, 3
ables, 8 ref.
fiers: *Rooting depth, Moisture level,
ure extraction patterns, Core samples,
ith samples.

ffects of 3 soil moisture levels - produced by
ion when 30, 65, or 80% of the available soil
ure had been removed in the root zone - on
evelopment of 8 cool-season forage species
letermined. Root patterns were characterized
ing 3-inch core samples, soil monolith sam-
and soil moisture extraction patterns. The
t of roots and the rooting depth varied with
ecies and soil moisture level. The effective
g depth decreased as soil moisture level in-
d. Roots from core samples show that over
f the total weight of roots were found in the
e 12 inches of soil for all species except tall
. Soil moisture extraction was used with
able accuracy to estimate effective rooting
s. (Bennett-USDA Agricultural Research
e)
08425

MOISTURE REGIME EFFECT ON YIELD
EVAPOTRANSPIRATION FROM WARM
ON PERENNIAL FORAGE SPECIES,
ultural Research Service, Thorsby, Ala. Soil
Water Conservation Research Div.; and
ma Agricultural Experiment Station, Au-

imary bibliographic entry see Field 02D.
08426

CTS OF SOIL MOISTURE REGIME ON
D AND EVAPOTRANSPIRATION FROM
-SEASON PERENNIAL FORAGE SPE-

ultural Research Service, Thorsby, Ala. Soil
Water Conservation Research Div.; and
ma Agricultural Experiment Station, Au-

imary bibliographic entry see Field 02D.
08427

CTS OF SOIL MOISTURE REGIME ON
D, NUTRIENT CONTENT, AND
OTRANSPIRATION OF THREE ANNUAL
GE SPECIES,
ultural Research Service, Thorsby, Ala. Soil
Water Conservation Research Div.; and
ma Agricultural Experiment Station, Au-

imary bibliographic entry see Field 02D.
08429

CT OF MOISTURE REGIME AND STAGE
LANT GROWTH ON MOISTURE USE BY
TON,
ultural Research Service, Thorsby, Ala. Soil
Water Conservation Research Div.; and
ma Agricultural Experiment Station, Au-

imary bibliographic entry see Field 02D.
08430

TURE USE BY VARIOUS PLANT SPE-
AND ITS RELATION TO PAN EVAPORA-
AND NET RADIATION,
ultural Research Service, Thorsby, Ala. Soil
Water Conservation Research Div.; and
ma Agricultural Experiment Station, Au-

imary bibliographic entry see Field 02D.
08431

MOISTURE USE BY FORAGE SPECIES AS RELATED TO PAN EVAPORATION AND NET RADIATION,
Agricultural Research Service, Thorsby, Ala. Soil and Water Conservation Research Div.; and Alabama Agricultural Experiment Station, Auburn.
B. D. Doss, O. L. Bennett, and D. A. Ashley.
Soil Science, Vol 98, No 5, p 322-327, 1964. 6 p, 3 fig, 2 tables, 15 ref.

Descriptors: *Water requirements, Moisture use, Evapotranspiration, Soil moisture, Pan evaporation.
Identifiers: *Net radiation, Greenville fine sandy loam.

Moisture-use rates were determined for alfalfa, coastal bermudagrass, and sorghum on Greenville fine sandy loam at Thorsby, Alabama. These rates varied with season of year, available soil moisture, stage of plant growth, and species. Moisture-use rates determined from gravimetric soil sampling throughout the growing season for each species were correlated separately with open pan evaporation and the evapotranspiration equivalent of net radiation. These correlations indicate that either open pan evaporation or net radiation may be used to estimate moisture use of forage crops under conditions where moisture is not limiting provided a relationship has been established for the given species. To estimate moisture use on a daily basis, the appropriate ET/E or ET/Rn ratio is multiplied by the measured daily pan evaporation or the evapotranspiration equivalent of net radiation. (Bennett-USDA Agricultural Research Service)
W69-08432

YIELD AND MINERAL COMPOSITION OF EIGHT FORAGE SPECIES GROWN AT FOUR LEVELS OF SOIL MOISTURE,
Agricultural Research Service, Thorsby, Ala. Soil and Water Conservation Research Div.; and Alabama Agricultural Experiment Station, Auburn.
Victor J. Kilmer, Orus L. Bennett, Virginia Stahly, and Donald R. Timmons.
Agronomy Journal, Vol 52, pp 282-285, 1960. 4 p, 5 tables, 7 ref.

Descriptors: *Soil moisture, Irrigation, Phosphorus, Moisture tensions.

The effect of soil moisture levels on the concentration of 12 elements was determined in field grown Atlantic and African alfalfa; red, intermediate white, and Ladino clover; fescue, reed canarygrass, and orchardgrass. The phosphorus content in all forage species increased as soil moisture supply increased but other elements were not consistently affected. (Bennett-USDA Agricultural Research Service)
W69-08433

EFFECT OF PLASTIC MULCH, HERBICIDE, AND TILLAGE ON MOISTURE USE AND YIELD OF CORN,
Agricultural Research Service, Thorsby, Ala. Soil and Water Conservation Research Div.; and Alabama Agricultural Experiment Station, Auburn.
B. D. Doss, O. L. Bennett, and D. A. Ashley.
Journal of Soil and Water Conservation, Vol 21, No 3, p 99-101, May-June, 1966. 3 p, 1 fig, 3 tables, 9 ref.

Descriptors: Moisture use.
Identifiers: *Conventional tillage, *Mulch tillage, Net radiation, Yields.

Corn was grown on a Faceville sandy loam soil to determine the effects of black plastic mulch, herbicide, and tillage on moisture use and yield. Average moisture-use rates were usually low while the plants were small and increased as the amount of vegetative growth increased. Maximum rates were reached during the ear development period. Moisture-use rates during the peak-use period were similar for all treatments, but the plastic mulch reduced moisture use during the early and late parts of the growing season. Plastic mulch over the soil surface increased rate of growth, tillering, lodging, grain yield, and stover production as compared with conventional tillage. Plastic mulch increased grain yields 7 to 14 bushels per acre over conventional tillage, which averaged 80 bushels per acre. Grain yields from the lister planter treatment (mulch-tillage) averaged 83 bushels per acre and were higher than conventional tillage for 2 of the 3 years. Grain yields for the conventional-chemical and small furrow treatments with no cultivation were about the same and averaged 14 bushels per acre lower than yields for conventional tillage. (Bennett-USDA Agricultural Research Service)
W69-08434

SNOW CATCH BY CONIFER CROWNS,
Forest Service (USDA), Moscow, Idaho. Forestry Sciences Lab.
For primary bibliographic entry see Field 02C.
W69-08436

FOREST DRAINAGE RESEARCH IN THE COASTAL PLAIN,
Forest Service (USDA), Charleston, S. C. Southeastern Forest Experiment Station.
For primary bibliographic entry see Field 04A.
W69-08437

DRAINAGE,
Forest Service (USDA), Charleston, S. C. Southeastern Forest Experiment Station.
For primary bibliographic entry see Field 04A.
W69-08438

SOILS INFORMATION USED AND NEEDED FOR WOODLAND PRODUCTION: RESEARCH FINDINGS - ORGANIC SOILS,
Forest Service (USDA), Charleston, S. C. Southeastern Forest Experiment Station.
For primary bibliographic entry see Field 04A.
W69-08441

SOIL MOISTURE RESPONSE TO SPRAYING BIG SAGEBRUSH WITH 2, 4-D,
Forest Service (USDA), Laramie, Wyo. Rocky Mountain Forest and Range Experiment Station.
Ronald D. Tabler.
J Range Manage, 1968, 21 (1): 12-15, Illus.

Descriptors: *Sagebrush, *Soil moisture, *Soil-water-plant relationships, *Evapotranspiration, Herbicides, Nuclear moisture meters, Brush control, Range management, *2-4-D.

Studies of soil moisture response to herbicidal control of big sagebrush were initiated one year prior to spraying and were continued for three years after treatment. Spraying big sagebrush with 2,4-D reduced the rate of soil moisture withdrawal. About 75% of the difference in total moisture depletion occurred within the 3- to 6-ft. soil depth; an opposite effect in the second foot indicated that the increase in grass herbage production is most strongly reflected in that zone. Total evapotranspiration losses from the 0- to 6-ft. soil profile were reduced about 14% over the four-month growing period the second year after spraying.
W69-08460

SUMMER DEFERRED GRAZING CAN IMPROVE DETERIORATED SEMIDESERT RANGES,
Forest Service (USDA), Albuquerque, N. Mex. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 04A.
W69-08462

LIBRARY U. OF L. URBANA-CHAMPAIGN

DEFERRED GRAZING AND SOIL RIPPING IMPROVES FORAGE ON NEW MEXICO'S RIO PUERCO DRAINAGE,
Forest Service (USDA), Albuquerque, N. Mex. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 04A.
W69-08463

INFLUENCE OF TEMPERATURE ON THE GERMINATION OF SOME RANGE GRASSES,
Forest Service (USDA), Albuquerque, N. Mex. Rocky Mountain Forest and Range Experiment Station.
O. D. Knipe.
J Range Manage, 20: 298-299.

Descriptors: *Temperature, Range grasses, Grasses, *Ranges, *Range science, *Germination.
Identifiers: Ground cover.

Boer lovegrass, galleta, and blue grama germinate relatively well within a temperature range of 60 degree to 100 degree F, but the range required for good germination of alkali sacaton and Lehmann lovegrass is limited to 80 degree to 90 degree and 60 degree to 70 degree F respectively.
W69-08467

SUMMER WATER USE BY ASPEN, SPRUCE, AND GRASSLAND IN WESTERN COLORADO,
Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
H. E. Brown, and J. R. Thompson.
J of Forestry 1965, 63 (10): 756-760, illus.

Descriptors: *Consumptive use, *Evapotranspiration, Soil moisture, Soil-water-plant relationships, *Water utilization, Vegetation effects.
Identifiers: *Water use.

Soil moisture was measured in spring and fall of 1955, 1957, and 1958 to determine relative amounts of water use on sites occupied by quaking aspen, Engelmann spruce, and mountain grassland during the summer growing season. Study plots were located on sites where the soil was deep enough to permit gravimeteric sampling to a depth of 8 feet. Water use was considered as the difference between soil moisture in the spring and fall, adjusted for summer precipitation. Aspen plots averaged 19.2 inches, spruce 14.9 inches, and grassland 8.9 inches of water use yearly for the 3 years of record. Because the amount of spring soil moisture was significantly different among types, however, and because spring moisture was correlated with water use in aspen and spruce types, it was impossible to attribute differences in water use solely to the type of vegetation.
W69-08468

REDUCTION OF LITTER AND SHRUB CROWNS BY PLANNED FALL BURNING OF OAK-MOUNTAINMAHOGANY CHAPARRAL,
Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
Charles P. Pase, and George E. Glendening.
USDA Forest Serv Res Note RM-49, illus, 1965. 2 p.

Descriptors: *Burning, *Brush control, *Chaparral, Ecology, Succession, Erosion, Canopy, Shrubs.
Identifiers: *Litter, *Prescribed burning, Live oak, Mountainmahogany, Litter reduction.

Shrubs were dried prior to burning by spraying with Dinoxol (tutoxy ethanol esters of 2,4-D and 2,4,5-T). Litter reduction varied from one-third to one-half; shrub canopy was reduced over 90 percent.
W69-08470

SHRUB SEEDLING REGENERATION AFTER CONTROLLED BURNING AND HERBICIDAL TREATMENT OF DENSE PRINGLE MANZANITA CHAPARRAL,
Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
Charles P. Pase.
USDA Forest Serv Res Note RM-56, illus, 1965. 2 p.

Descriptors: *Ecology, *Succession, *Burning, Brush control, Herbicides, Chaparral, 2-4-D.
Identifiers: *Manzanita, Shrub seedlings, Regeneration.

Planned fall burning of dense manzanita chaparral was followed by large increases in seedlings of yerba-santa, Pringle manzanita, desert ceanothus, and five other brush species. Seedlings of most shrub species were virtually absent from an adjacent unburned area, and from an area sprayed with 2,4-D but not burned.
W69-08471

HELICOPTER-APPLIED HERBICIDES CONTROL SHRUB LIVE OAK AND BIRCHLEAF MOUNTAINMAHOGANY,
Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 03B.
W69-08486

PERPETUAL SUCCESSION OF STREAM-CHANNEL VEGETATION IN A SEMIARID REGION,
Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 03B.
W69-08489

WATER TABLE CHARACTERISTICS UNDER TAMARISK IN ARIZONA,
Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 03B.
W69-08490

GUIDE FOR SURVEYING PHREATOPHYTE VEGETATION,
Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 03B.
W69-08491

SURFACE RESISTANCE OF CROP CANOPIES,
Rothamsted Experimental Station, Harpenden (England).
For primary bibliographic entry see Field 02D.
W69-08573

2J. Erosion and Sedimentation

SAMPLING AND ANALYSIS OF COARSE RIVERBED SEDIMENTS,
Agricultural Research Service, Oxford, Miss. Sedimentation Lab.
T. C. Muir.
Proc Miss State Univ Water Resources Res Inst Conf, State Univ Water Resources Res Inst Conf, State Coll, Apr 8-9, 1969, pp 73-83, 1969. 11 p, 3 fig, 2 tab, 10 ref.

Descriptors: *Sedimentology, *Sampling, *Statistical methods, Sediment transport, Rivers, Streams, Gravels, Sands, Dredging, Particle shape, Particle size.
Identifiers: Areal sampling, Volumetric sampling.

Volumetric, or bulk, sampling of river gravel normally requires considerable effort and equipment and often may not be feasible. Samples may not be representative of the sediment deposit. The depth to which the sample should be taken is usually unknown and affects the shape of the particle size distribution curve. A recommended standard procedure for areal, or surface, sampling is t
tion by the grid method of particles larger t
mm, determination of the arithmetic mean
triaxial dimensions of each particle, and plott
the particle size distribution on a number fre
cy basis. The areal sampling technique can pr
a sample representative of a large area, may b
ried out in shallow water, and all measure
may be completed in the field. Areal sampli
gravel deposits can yield estimates of particle
usually obtained from bulk samples. The proc
may be used in studies of hydraulic roug
channel stability, bed armoring, sediment tra
and in the general classification of river proc
(See W69-08221). (Knapp-USGS)
W69-08223

NEW DATA ON GEOMORPHOLOGY RECENT SEDIMENTS OF THE BERING AND THE GULF OF ALASKA,
All-Union Research Inst. of Marine Fisherie
Oceanography, Moscow (USSR).
D. E. Gershanovich.
Marine Geol, Vol 6, No 4, pp 281-296, Aug
16 p, 9 fig, 7 ref.

Descriptors: *Sedimentation, *Continental
*Continental slope, *Oceans, *Alaska, Sedim
tion rates, Provenance, Geomorphology.
Identifiers: Geosynclines, Bering Sea.

Soviet marine geological surveys in the Beri
and Gulf of Alaska showed considerable
ferences in epicontinental and geosynclinal
mentation. Epicontinental regions of the B
Sea are covered by terrigenous sediments o
ferent granulometry. Diatom sediments priv
the zone of the continental slope and especia
the deep zone of the Bering Sea. They are
more abundant in this area than in the neighb
areas of the north Pacific Ocean. In most
areas of the Komandor-Aleutian island ar
rigenous deposits are prevalent. In the easter
of the Aleutians, both in the Bering Sea and
Pacific Ocean, terrigenous-volcanic and vo
deposits are abundant. In the shelf and conti
slope of the Gulf of Alaska terrigenous and
lesser degree volcanic and foraminiferous
diatomous deposits are found. Near the reg
continental glaciation, glacial-marine and tur
current sediments occur. The rate of the
sedimentation is very high everywhere. It
from 2 to 30 cm/1,000 yr on the shelf of the B
Sea to 40 cm/1,000 yr in the lower inclined p
the continental slope. (Knapp-USGS)
W69-08249

STREAMS IN LARGE ALLUVIAL BED HIGH SLOPE,
Naples Univ. (Italy). Hydraulic Lab.
M. Viparelli, and M. Pica.
Congress held at Ft. Collins, Colo. Proc Int A
Hydraul Res, 12th Congr, Vol 1, A8, pp
1967. 11 p.

Descriptors: *Model studies, *Alluvial cha
*Sediment transport, *Particle size, Flow
Profiles, Streambeds, Hydraulic properties, S
Channels, Sediments.
Identifiers: *Italy, Experimental research.

To find out the fundamentals of fluvial sed
transport in streams in large alluvial beds o
slope, an experimental research project wa
ducted at the Hydraulic Laboratory,
University, Italy. A sandy bottom channel,
wide and 18 m long was employed. Systemati
were made with sands of two textures an
three rates or water flow: 3, 1.5, and 0.75
Other tests were made with channel width re
to 0.30 m. Measured sand discharges and b
profile changes show that the sediments a
local slopes continuously vary around their a
values without apparent cause. Higher
slopes show a linear relation between slop
sand discharges for each sand size and each
flow. For smaller slopes sand discharge dec
slowly with decreasing slope. (Lang-USGS)

:258

CE RUNOFF AND EROSION IN THE R CHAPARRAL ZONE, ARIZONA,
Service (USDA), Tempe, Ariz. Rocky in Forest and Range Experiment Station.
nary bibliographic entry see Field 04D.
:474

ON AND SEDIMENT MOVEMENT FOL-IG A WILDFIRE IN A PONDEROSA OREST OF CENTRAL ARIZONA,
Service (USDA) Tempe, Ariz. Rocky in Forest and Range Experiment Station.
nary bibliographic entry see Field 04D.
:475

G IN RELATION TO RUNOFF AND ON ON SOME CHAPARRAL RSHEDS OF CENTRAL ARIZONA,
Service (USDA), Tempe, Ariz. Rocky in Forest and Range Experiment Station.
nary bibliographic entry see Field 04D.
:476

BILITY INDICES FOR WILDLAND OF OAHU, HAWAII, AS RELATED TO ORMING FACTORS,
Service (USDA), Berkeley, Calif. Pacific est Forest and Range Experiment Station.
Yamamoto, and Henry W. Anderson.
Resources Research, 3 (3), (1967):785-798.

tors: *Erosion, *Soil aggregages, *Cohe-Soil formation, *Laboratory tests, Soil g, Basalts, Igneous rocks, Vegetation ef-umid climates, Mapping, Reforestation.
ers: Erodability, Erosion ratios.

ntation potential of wildlands. Month by urbanization is invading Hawaii's forest Many people are asking: 'Does this invasion threat to the protection capacity of the eds.' Soil characteristics help determine the of allowable disturbance and the kind and y of conservation practices needed. Indices erodibility of Oahu's wildland soils were ob-y principal component analysis of 7 charac-which can be determined from maps and photographs: geologic rock type, rainfall, n, vegetation type, slope, aspect and zone. ic parent rock was found to be the most im-factor in differentiating erodibility of wildland soils. However, the study showed e native dominant koa-ohia was naturally easily eroded small aggregates. In contrast ui, and planted forest stands of paperbark oak were consistently low in erodibility. g of trees which favor development of less e soils may be promoted. Generalized map erodibility of soils in Oahu was combined rainfall map, indicating where care in ment might be most needed.
:482

PLICATION OF MULTIVARIATE ANAL-O SEDIMENT NETWORK DESIGN,
Service (USDA), Berkeley, Calif. Pacific est Forest and Range Experiment Station.
nary bibliographic entry see Field 07A.
:497

ON AND SEDIMENTATION,
Service (USDA), Berkeley, Calif. Pacific est Forest and Range Experiment Station.
V. Anderson.
Rpt XIV General Assembly IUGG, Trans eophys Union 49 (2), (1967): 697-700.

tors: *Erosion control, *Sedimentation, erosion, *Sediment transport, *Reviews, ations, *United States, Laboratory tests, oratories, Analytical techniques, Vegeta-cts, Land use.
rs: Land erosion.

Summarizes progress in erosion and sedimentation research in the United States during the four years 1962-1966. A computer program was used to search some 300 publications titles and keywords, under headings keyed to laboratory and flume studies; studies of soil, watershed, and land use effects; studies of mechanical control; studies of vegetative control and developments in instrumentation and techniques. 73 papers are cited.
W69-08507

SURFACE SOIL TEXTURE AND POTENTIAL ERODIBILITY CHARACTERISTICS OF SOME SOUTHERN SIERRA-NEVADA FOREST SITES,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 02G.
W69-08513

STUDIES ON CONNECTICUT LAKE SEDIMENTS. II. CHEMICAL ANALYSES OF A CORE FROM LINSLEY POND, NORTH BRANFORD,
Yale Univ., New Haven, Conn. Osborn Zoological Lab.
For primary bibliographic entry see Field 02H.
W69-08521

EFFECT OF SEDIMENT CONCENTRATION ON WELL RECHARGE IN A FINE SAND AQUIFER,
Texas A and M Univ., College Station; and Florida Univ., Gainesville.
For primary bibliographic entry see Field 02F.
W69-08574

RECENT CARBONATE SEDIMENTATION BY TIDAL CHANNELS IN THE LOWER FLORIDA KEYS,
State Univ. of New York, Binghamton. Dept. of Geology.
For primary bibliographic entry see Field 02L.
W69-08577

THE SIGNIFICANCE AND LIMITATIONS OF STATISTICAL PARAMETERS FOR DISTINGUISHING ANCIENT AND MODERN SEDIMENTARY ENVIRONMENTS OF THE LOWER GEORGIA COASTAL PLAIN,
Goldsmiths' Coll., London (England). Dept. of Geology and Geography; and Georgia Univ., Sapelo Island. Marine Inst.
For primary bibliographic entry see Field 02L.
W69-08578

EROSIONAL CURRENT MARKS OF WEAKLY COHESIVE MUD BEDS,
Reading Univ. (England). Sedimentology Research Lab.
J. R. L. Allen.
J Sediment Petrol, Vol 39, No 2, pp 607-623, June 1969. 17 p, 18 fig, 1 tab, 28 ref.

Descriptors: *Erosion, *Mud, *Sedimentary structures, *Scour, *Turbulent flow, Regime, Deltas, Sediment-water interfaces, Ripple marks, Streamflow, Stream erosion, Model studies, Hydraulic models, Flow separation.
Identifiers: Flute marks, Weakly cohesive sediments.

The manner in which a bed of weakly cohesive mud is eroded by a plain, turbulent flow of water is found experimentally to depend on the severity of the flow over the bed. The major structures left behind on a weakly cohesive mud bed after a prolonged period of erosion also depend on the severity of flow. With ascending severity, we obtain: (1) longitudinal rectilinear grooves, (2) longitudinal meandering grooves, (3) flute marks, and (4) transverse erosional markings. The more severe flows also give rise to shear wrinkles and to erosional structures of a less well defined nature. Of the 4 structures, all but longitudinal rectilinear grooves have counterparts in the fossil record. Of particular importance is evidence confirming that flute marks are associated with separated flows and are due to processes of flow separation and reattachment. (Knapp-USGS)
W69-08579

THE SEDIMENTOLOGY OF A BRAIDED RIVER,
Ottawa Univ., Ontario. Dept. of Geology.
Peter F. Williams, and Brian R. Rust.
J Sediment Petrol, Vol 39, No 2, pp 649-679, June 1969. 31 p, 28 fig, 5 tab, 22 ref, 2 append.

Descriptors: *Sedimentology, *Rivers, *Braiding, Meanders, Deposition (Sediments), Alluvium, Aggradation, Erosion, Particle size, Particle shape, Discharge (Water), Streamflow, Channel morphology, Clays, Sands, Silts, Gravels, Mud, Regime, Ripple marks, Sedimentary structures, Sand waves.
Identifiers: *Canada, Sedimentary facies, Yukon.

A straight, 4-mile tract of the Donjek River, Yukon, Canada is braided throughout, discharging about 50,000 cfs in flood. The active part of the tract shows upper regime flow in the main channels, and lacks vegetation. Higher, older levels are former river courses, partly or completely vegetated, with continuous flow (principally lower regime) only in the main channels. Comparing channel (width; depth) and topographic indices, the younger surfaces are more strongly dissected because of active channel cutting, whereas channels on older levels are subject to infilling. The sediments vary from clays to coarse gravels; most are poorly sorted. CM plots permit division into 3 main groups: silt and mud of low energy environments such as abandoned channels, gravel of high energy channel-bar complexes, and a variable intermediate group which fills channels under medium-energy conditions. Seven facies are distinguished on textural, floral, and sedimentary structural characteristics. Facies relations are mostly gradational within channels, commonly fining upwards. They are more complex between channels, and invariably erosional. The origin and directional significance of hierarchical orders of sedimentary structures were studied. Six hundred and sixty measurements of small-scale structures (mostly ripples) show moderate within-bar and between-bar variation, and give a grand vector mean 22 deg. from the river trend. Bisectors of channel directional arcs (maximum and average ranges) approximate the river trend within 5 deg. (Knapp-USGS)
W69-08580

PRECIPITATION AND LITHIFICATION OF DEEP-SEA CARBONATES IN THE RED SEA,
Woods Hole Oceanographis Institution, Mass.
John D. Milliman, David A. Ross, and Teh-Lung Ku.
J Sediment Petrol, Vol 39, No 2, pp 724-736, June 1969. 13 p, 14 fig, 2 tab, 41 ref.

Descriptors: *Sedimentation, *Diagenesis, *Water quality, *Water chemistry, Carbonates, Calcite, Sands, Silts, Mud, Deposition (Sediments), Chemical precipitation, Sea water, Evaporation, Salinity, Trace elements.
Identifiers: *Red Sea, Aragonite.

More than one-half of the deep-sea carbonates in the Red Sea are estimated to have been inorganically precipitated. Aragonite-cemented layers were formed during glacially lowered stands of sea level, when Red Sea waters were highly saline. Some magnesian calcite lithic fragments might represent inverstion products of aragonite; others are believed to have been precipitated directly from normal Red Sea water. Chemical mineralogical and petrographic similarities with lithic fragments suggest that the magnesian calcite portion of the Red Sea lutite was also inorganically precipitated. Similar inorganic carbonate precipitation probably occurred in the Mediterranean Sea, during glacially lowered sea level. (Knapp-USGS)
W69-08581

LIBRARY U. OF I., HONOLULU-CHAMPAIGN

AN INEXPENSIVE RECORDING SETTLING TUBE FOR ANALYSIS OF SANDS,
University of Southern California, Los Angeles.
For primary bibliographic entry see Field 07B.
W69-08582

CALIBRATION OF THE UNIVERSITY OF SOUTHERN CALIFORNIA AUTOMATICALLY RECORDING SETTLING TUBE,
University of Southern California, Los Angeles. Dept. of Biology.
For primary bibliographic entry see Field 07B.
W69-08583

A CONTACT GAGE FOR RAPID AND ACCURAGE THREE-DIMENSIONAL GRAIN SIZE MEASUREMENT OF LOOSE SAND PARTICLES,
Pennsylvania State Univ., University Park. Dept. of Geology and Geophysics; and National Iranian Oil Co., New York.
For primary bibliographic entry see Field 07B.
W69-08584

A RAPID METHOD FOR THE DETERMINATION OF SHAPE, SPHERICITY AND SIZE OF GRAVEL FRAGMENTS,
Ibadan Univ. (Nigeria). Dept. of Geology.
For primary bibliographic entry see Field 07B.
W69-08585

A NOTE ON THE RELATIONSHIP OF GRAIN SIZE, CLAY CONTENT, QUARTZ AND ORGANIC CARBON IN SOME LAKE ERIE AND LAKE ONTARIO SEDIMENTS,
Department of Energy, Mines and Resources, Burlington (Ontario). Canada Centre for Inland Waters.
R. L. Thomas.
J Sediment Petrol, Vol 39, No 2, pp 803-809, June 1969. 7 p, 5 fig, 2 tab, 14 ref.

Descriptors: *Sediments, *Lake Erie, *Lake Ontario, *Organic matter, Clays, Sands, Silts, Carbon, Organic compounds, Great Lakes, Deposition (Sediments), Quartz, Sedimentation, Particle shape, Particle size.
Identifiers: Great Lakes sediments.

An examination of the geochemistry of fine-grained sediments in relation to size frequency distribution was carried out on sediment samples from Lakes Erie and Ontario. This study demonstrated a direct relationship between the under 2 micron grain size and the theoretical clay content computed from the organic carbon, quartz and carbonate content. A sympathetic relationship was observed between clay content and organic carbon, and also between median grain size and quartz content. The former relationship is believed to be the result of absorption from solution and the latter is brought about by natural sedimentation from suspension. (Knapp-USGS)
W69-08586

DISPERSION OF SILT PARTICLES IN OPEN CHANNEL FLOW,
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
William W. Sayre.
ASCE Proc, J Hydraul Div, Vol 94, No HY3, Pap 6579, pp 1009-1038, May 1969. 30 p, 13 fig, 2 tab, 15 ref, append.

Descriptors: *Sediment transport, *Suspended load, *Model studies, *Mathematical models, *Dispersion, Digital computers, Hydraulic models, Tracers, Diffusion, Turbulent flow, Open-channel flow, Sediment transport, Silts, Equations.
Identifiers: Shear flow, Silt suspensions.

The dispersion process for sediment particles in a 2-dimensional turbulent shear flow is formulated in 2 differential equations, 1 for particles suspended in the flow and the other for those deposited on the bed. Exchange of particles between the bed and the flow is permitted. Using the Aris moment transformations, the equations are converted to a more tractable system of equations which are solved by numerical methods with the aid of a digital computer, for the zero, first, second and third moments of the longitudinal concentration distributions. Various combinations of boundary and other input conditions are imposed and their effects on the dispersion process are demonstrated. The results of the numerical solutions together with the results of earlier dispersion experiments with silt particles and fluorescent dyes show that the tendency of the silt particles toward deposition and temporary storage on the bed can profoundly affect the longitudinal dispersion process. (Knapp-USGS)
W69-08592

ELECTRON MICROSCOPY OF CHEMICAL SOLUTION AND MECHANICAL ABRASION FEATURES ON QUARTZ SAND GRAINS,
Florida State Univ., Tallahassee. Dept. of Geology.
Stanley V. Margolis.
Sediment Geol, Vol 2, No 4, p 243-256, Dec 1968. 14 p, 13 fig, 1 tab, 18 ref.

Descriptors: *Beaches, *Sands, *Abrasion, *Pitting (Corrosion), *Quartz, Waves (Water), Weathering, Corrosion, Electron microscopy, Chemical properties.
Identifiers: Quartz grain etching.

Crystallographically oriented etch pits have been observed on quartz sand grains from marine environments, using an electron microscope. Similar features have been produced by etching quartz in the laboratory with hydrofluoric acid and sodium hydroxide. Examination of quartz sand grain surfaces from beaches of different wave intensities along the Atlantic and Gulf coasts of the United States suggests a relationship between the effects of such chemical solution features and mechanical abrasion on sand grains. Sand grains from beaches with low wave activity exhibit oriented etch pits readily attributed to the solution of quartz by sea water. These features are the surface expression of defects within the crystal. Sand grains from beaches with moderate wave energy show a combination of chemical etch features and those phenomena thought to be caused by grain-to-grain impacts, while grains from high-energy beaches predominantly show impact features. If the correlations shown by the results are valid, the relative number of chemical and mechanical features on sand grains can be used to determine energy conditions along ancient shorelines. (Knapp-USGS)
W69-08607

'PEBBLE CLUSTERS': THEIR ORIGIN AND UTILIZATION IN THE STUDY OF PALAEOCURRENTS,
Ferrara Univ. (Italy). Inst of Geology.
Renzo Dal Cin.
Sediment Geol, Vol 2, No 4 p 233-241, Dec 1968. 9 p, 5 fig, 12 ref.

Descriptors: *Sediment distribution, *Bed load, *Gravels, *Paleohydrology, *Sediment transport, Sedimentation, Sediment load, Running waters, Distribution patterns, Deposition (Sediments), Sedimentary structures.
Identifiers: *Pebble clusters, *Paleocurrent indicators.

'Pebble clusters' are characteristic of some coarse, poorly-sorted fluvial deposits; they form when pebbles in the course of transport are stopped by cobbles or boulders protruding from the river bed. In this way wake-like piles of coarse particles accumulate in front of the obstacle which stopped them. 'Pebble clusters' offer excellent indications of the direction of the current, because they are always parallel, or nearly so, to the direction of the current and because the wake is almost always upstream and the boulder downstream. Furthermore, their presence in conglomerates of unknown origin offers evidence of unidirectional transport and excludes beach deposits. Finally, 'pebble clusters' are also a clue to the mode of deposition of the cles; clusters require selective transport rathe mass transport. (Knapp-USGS)
W69-08608

2K. Chemical Processes

Fe, Mn, Ni, Co, Sr, Li, Zn, and SILIC STREAMS OF THE LOWER KANSAS R BASIN,
Kansas State Geological Survey, Lawrence Kansas Univ., Lawrence.
For primary bibliographic entry see Field 05A
W69-08204

PLANT NUTRIENTS IN BASE FLOW STREAMS IN SOUTHWESTERN WISCONS
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 05B
W69-08205

SOLUTIONS IN INTERTIDAL SUPRATIDAL ENVIRONMENTS OF MOD CARBONATE SEDIMENTATION: THEIR PLICATION ON DIAGENESIS,
Georgia Univ., Athens. Dept. of Geology.
Hartmut U. Wiedemann.
Chem Geol, Vol 4, No 3-4, pp 393-409, June 17 p, 5 fig, 3 tab, 21 ref. NORN-552 (07)-ON

Descriptors: *Chemical precipitation, *V chemistry, *Lithification, *Diagenesis, *Eva tion, Sea water, Calcite, Carbonates, Gyp Limestones, Salts, Magnesium, Tides, Leachin
Identifiers: *Bimini (Bahamas).

When sea water is trapped and evaporated i intertidal zone of tropical coasts, calcium bonate precipitates as consequence of incre concentrations. The precipitation takes place on surfaces where calcium carbonate is al present. Beachrock formation on Bimini, Baha can be attributed entirely to precipitatio aragonite cement from sea water. Because o low solubility of calcium salts as compared higher solubility of halite and magnesian sa chemical separation of calcium and magne takes place during evaporation of sea water as as upon dissolution of sea salt in rain water solution of sea salt yields magnesium-rich solu with initial pH values above 9 over a wide ran concentrations prior to equilibration with th mospheric carbon dioxide. The counterpa these magnesium-rich solutions is rich in calc exhibits pH values around pH 8 and ten decompose unstable magnesian-calcite an precipitate calcium carbonate and gypsum d evaporation. The tendency for calcium sulfa precipitate in an early stage of evaporation b redissolve readily makes gypsum a conve short-term depot for calcium ions in intertida supratidal environments. (Knapp-USGS)
W69-08218

DIGITAL-COMPUTER APPLICATIONS CHEMICAL-QUALITY STUDIES OF SURF WATER IN A SMALL WATERSHED.
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07C
W69-08234

ALGAE: AMOUNTS OF DNA AND ORG CARBON IN SINGLE CELLS.
California Univ., San Diego, La Jolla. In Marine Resources.
Osmund Holm-Hansen.
Science, Vol 163, pp 87-88, January 1969. 11 ref.

Descriptors: *Algae, *Carbon, *Carbon *Cytological studies, Cultures, Fluoro Biomass, Oceanography
Identifiers: *DNA, *Organic carbon, *Cell Eukaryotes, Monochrysis lutheri, Navicula p

, Gonyaulax polyedra, 3,5-diaminobenzoic acid drochloride, Infrared gas analysis, Coulter nter, Euglena gracilis, Cachonina niei, letonema costatum, Dunaliella tertiolecta, Amlinium carteri, Syracosphaera elongata, Thalasra fluviatilis, Ditylum brightwellii, Biological nography, Ecological techniques.

izing infrared gas analysis for carbon and rometry for desoxyribonucleic acid (DNA), or analyzed the following variously sized spe- of unicellular algae: Monochrysis lutheri, icula pelliculosa, Gonyaulax polyedra, honina niei, Skeletonema costatum, Dunaliella olecta, Amphidinium carteri, Syracosphaera gata, Thalassiosira fluviatilis, Ditylum htwellii. Carbon content varied from 10 to 0 picograms per cell, and total cellular DNA is ctly proportional to cell size. Content of DNA qual to approximately 1-3% of cellular organic on. Data and relationships developed in this y suggest that DNA-determinations are of ntial value in determining living biomass in logical studies. (Eichhorn-Wis)
9-08278

ESTIGATION OF THE GEOCHEMISTRY WATER IN A SEMIARID BASIN ARIZONA, A.,
logical Survey, Tucson, Ariz. Water Resources

primary bibliographic entry see Field 02F.
9-08300

TER QUALITY AS AFFECTED BY A OMING MOUNTAIN BOG,
est Service (USDA), Laramie, Wyo. Rocky untain Forest and Range Experiment Station.
primary bibliographic entry see Field 05B.
9-08455

OSS ALPHA AND BETA RADIATION IN TERS AT A WYOMING MOUNTAIN BOG,
est Service (USDA), Laramie, Wyo. Rocky untain Forest and Range Experiment Station.
primary bibliographic entry see Field 05B.
9-08457

TURAL AND POLLUTION SOURCES OF INE, BROMINE, AND CHLORINE IN THE EAT LAKES,
higan Univ., Ann Arbor. Dept. of Meteorology Oceanography.
primary bibliographic entry see Field 05A.
9-08562

CIPITATION AND LITHIFICATION OF P-SEA CARBONATES IN THE RED SEA,
ds Hole Oceanographis Institution, Mass.
primary bibliographic entry see Field 02J.
1-08581

OTE ON THE RELATIONSHIP OF GRAIN E, CLAY CONTENT, QUARTZ AND OR- IC CARBON IN SOME LAKE ERIE AND E ONTARIO SEDIMENTS,
artment of Energy, Mines and Resources, ington (Ontario). Canada Centre for Inland ers.
primary bibliographic entry see Field 02J.
-08586

EOLIMNETIC SALINITY OF DZUNGAR ORDOS BASINS,
primary bibliographic entry see Field 02H.
-08594

CTRON MICROSCOPY OF CHEMICAL UTION AND MECHANICAL ABRASION TURES ON QUARTZ SAND GRAINS,
da State Univ., Tallahassee. Dept. of Geology.
primary bibliographic entry see Field 02J.

W69-08607

2L. Estuaries

SOLUTIONS IN INTERTIDAL AND SUPRATIDAL ENVIRONMENTS OF MODERN CARBONATE SEDIMENTATION: THEIR IMPLICATION ON DIAGENESIS,
Georgia Univ., Athens. Dept. of Geology.
For primary bibliographic entry see Field 02K.
W69-08218

NEW DATA ON GEOMORPHOLOGY AND RECENT SEDIMENTS OF THE BERING SEA AND THE GULF OF ALASKA,
All-Union Research Inst. of Marine Fisheries and Oceanography, Moscow (USSR).
For primary bibliographic entry see Field 02J.
W69-08249

DESCRIPTION OF THE HYDROLOGIC REGIME OFF THE GRAIN AND IVORY COASTS BETWEEN ABIDJAN AND MONROVIA (FRENCH),
Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France).
J. R. Donguy, and M. Prive.
Cah O.R.S.T.O.M., Ser Oceangr, Vol 6, No 2, pp 47-51, 1968. 5 p, 14 fig, 18 ref.

Descriptors: *Hydrologic properties, *Coasts, *Estuarine environment, Dynamics, Salinity, Seasonal, Sea water Thermocline, Isotherms, Temperature, Topography, Pressure, Winds, Mapping, Currents (Water).
Identifiers: *Africa, Ivory Coast, Grain Coast.

The coastal water hydrologic regime between Abidjan and Monrovia, Africa, is described. Data were collected by the R/V 'Reine Pokou' of the Center of Oceanographic Research off the Ivory Coast during 1964 expedition. The article contains maps of salinity, surface water temperature, isotherms, thermoclines, and surface topographic dynamics. Far away from the coastal strip, the hydrographic conditions are identical with those of the South Atlantic. Some dissimilarity was found between the seasons of the Ivory Coast and the Grain Coast. (Gabriel-USGS)
W69-08255

ESTUARIAL SYSTEMS ANALYSIS QUANTITY AND QUALITY CONSIDERATIONS,
Water Resources Engineers, Inc., Walnut Creek, Calif.
Gerald T. Orlob.
Proc, Nat Symp Anal Water Resource Syst, pp 341-358, Denver, July 1968. 18 p, 9 fig.

Descriptors: *Estuarine environment, *Networks, *Hydrodynamics, *Systems analysis, *Quality control, Mathematical models, Hydrologic properties, Advection, Diffusion, Water resources, Time, Discharge (Water).
Identifiers: *San Francisco Bay-Delta System, Australia.

A technique for representing the complex hydrodynamic behavior of estuarial environments through a mathematical model comprised of a network of one dimensional channel elements was described. The equations of motion for each element and of continuity for each node in the network were solved over a time continuum to produce a dynamic response to tides and hydrologic flumes imposed at the boundaries of the model. Histories of discharge, velocity, area and tidal elevations were generated for each element or node in the system and supplied as input information to a compatible water quality model. Quality behavior was simulated by satisfying mass balance equations for conservative and nonconservative substances at nodes and by transporting materials between nodes according to advective and diffusional properties of the system. Examples of model application were given for the San Francisco Bay-Delta System and two estuaries in Australia. Suggestions were made for future research on estuarial hydrodynamics and water quality and for the application of systems analysis as a tool in water resource management. (Thiuri-Cornell)
W69-08537

RECENT CARBONATE SEDIMENTATION BY TIDAL CHANNELS IN THE LOWER FLORIDA KEYS,
State Univ. of New York, Binghamton. Dept. of Geology.
Vladimir Jindrich.
J Sediment Petrol, Vol 39, No 2, pp 531-553, June 1969. 23 p, 14 fig, 1 tab, 34 ref.

Descriptors: *Sedimentation, *Limestones, *Tidal waters, *Currents (Water), *Florida, Deltas, Channel morphology, Sedimentary structures, Ripple marks, Diagenesis, Sand waves, Conglomerate rocks.
Identifiers: Key West (Fla).

Bluefish Channel, north of Key West, Florida, is a prominent ebb channel incised into a thick Recent carbonate bank that overlies Pleistocene limestone. The dominant sediments are Halimeda, foraminifera, molluscs, and fragments derived from the Pleistocene bedrock. Because the source area is the entire course of the channel, sediment mixing results in textural inversions (abnormal size-to-roundness relations) and characteristically negatively-skewed channel sands. A plot of sorting vs grain size of sediments of energy-levels reveals a sinusoidal trend similar to that of beach sediments. With increased sorting and abrasion, the constituents tend to be distributed proportionally in the sediment. The best sorted sediment is mature medium calcarenite, a mixture of 4 constituents in almost equal proportions. Some calcarenites deposited at the tidal delta show the initial stages of cementation by chemically precipitated aragonite crystals. Hydrodynamically, the channel is characterized by the upper-flow regime. The most conspicuous bed forms are straight-crested magaripples at the channel mouth and adjacent parts of the rapidly growing tidal delta. Here beds of cohesive carbonate muds are exposed to submarine erosion, producing armored mud balls and intraformational flat-pebble conglomerates, identical with some of those interpreted as a product of supratidal environment. (Knapp-USGS)
W69-08577

THE SIGNIFICANCE AND LIMITATIONS OF STATISTICAL PARAMETERS FOR DISTINGUISHING ANCIENT AND MODERN SEDIMENTARY ENVIRONMENTS OF THE LOWER GEORGIA COASTAL PLAIN,
Goldsmiths' Coll., London (England). Dept. of Geology and Geography; and Georgia Univ., Sapelo Island. Marine Inst.
John R. Hails, and John H. Hoyt.
J Sediment Petrol, Vol 39, No 2, pp 559-580, June 1969. 22 p, 10 fig, 5 tab, 22 ref. Grants NSF-GP 1380 and NSF-GA 704.

Descriptors: *Sedimentation, *Particle size, *Statistical methods, Coasts, Estuaries, Tidal marshes, Beaches, Sands, Sand bars, Currents (Water), Waves (Water), Paleohydrology, Deposition (Sediments), Erosion, Sediment transport.
Identifiers: Georgia Coastal Plain.

The lower Coastal Plain of Georgia is a significant area for the study of preserved coastline sediments because ancient deposits are generally well preserved. Samples were collected from 6 Pleistocene barrier coastlines and the Holocene coast to evaluate the statistical parameters for distinguishing ancient and modern sedimentary environments. The sediments of each barrier coastline can be subdivided into lagoon-salt marsh and barrier-island facies. The lagoon-salt marsh facies includes estuarine and tidal channel sediments, and the barrier facies includes dune, littoral, shallow neritic and offshore channel deposits. Barrier

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island sands are better sorted than those from lagoon-salt marsh environments although all samples have mean grain size values higher than 1.50 phi. The coarsest sediments in the barrier island environments are found in the tidal inlets and channels, and about 70% of the samples are negatively skewed. About 30% of the lagoon-salt marsh sands are positively skewed. More than 90% of the Holocene beach sands are negatively skewed, but about 70% of the dune sands show positive skewness. The sign of skewness in this study is related to energy variations in different sedimentary environments. (Knapp-USGS)
W69-08578

OBSERVATIONS OF MOTION AT INTERMEDIATE AND LARGE SCALES IN A COASTAL PLAIN ESTUARY,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
Glenn A. Cannon.
Chesapeake-Bay Inst Tech Rep No 52, Mar 1969. 116 p, 26 fig, 13 tab, 25 ref. Contract No. Nonr 4010 (11) ONR. Proj No NR 083-016 ONR.

Descriptors: *Currents (Water), *Estuaries, Current meters, Streamflow, Velocity, Tides, Seiches, Regression analysis, Turbulence, Water circulation, Waves (Water).
Identifiers: *Chesapeake Bay, Kinetic energy density spectra, Patuxent estuary.

Observations of motion at intermediate and large scales were made in a coastal plain estuary using current meters consisting of 2 propellers rigidly attached to a bottom mounted tower, oriented at right angles to each other to measure the horizontal velocity vector. At large scales the results indicated that estimates of river flow from observations of current velocity and salinity can be difficult and that bottom friction may have more effect on tidal currents in the estuary than was previously known. Spectra of kinetic-energy density at intermediate frequencies were similar in one run over horizontal distances of 500 m, and they could be satisfactorily represented in 2 frequency bands by straight lines (on log-log plots) with a -5/3 slope. Between the 2 regions with -5/3 slopes, there was an increase in the energy level in both velocity components by a factor of about 2. The natural period for cross-channel seiching occurred in the same interval. Spectra from the other 2 runs showed significant time changes. Estimates of coherence at intermediate frequencies using record lengths of several tidal cycles appeared to be unreliable, and the phases appeared to vary randomly as a function of frequency. (Knapp-USGS)
W69-08598

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DESALINATION-POWER PLANT PROVES ECONOMICALLY FEASIBLE,
Kaiser Engineers, Oakland, Calif.
P. D. Bush, J. Finke, and J. R. Wilson.
Environmental Science and Technology, Vol 2, No 6, pp 428-434, June, 1968. 6 p, 4 fig.

Descriptors: *Variable costs, *Desalination plants, *Electric power production, Alternative costs, Annual costs, Capital costs, Unit costs, Economic feasibility, Electric power rates, Initial costs, Maintenance cost, Operating costs.
Identifiers: *Desalination-power plant, Israel.

This paper reports on an engineering feasibility and economic study of a dual-purpose power generation and desalinization plant to be located in Israel. The proposed plant (100 m.g.d.) was 40 times larger than any operating at that time. Estimated unit water cost studies were followed by studies of capital cost variants and annual cost variants in an effort to evaluate their effect on unit water cost. These studies show that the variables can only affect unit cost of water from dual-purpose plants by 15%, from best to worst conditions. Also revealed is that the desalting plant design which is optimum for one fixed charge rate may be used for other fixed charge rates with essentially no economic penalty. (Sherbrooke-Ariz)
W69-08295

REVERSE OSMOSIS MEMBRANE REGENERATION,
American Standard Inc., New Brunswick, N. J.
E. A. G. Hamer, and R. L. Kalish.
OSW R and D Report No 471, OSW 14-01-0001-1171, 1969. 80 p.

Descriptors: *Desalination, *Reverse osmosis, *Membranes, Regeneration.
Identifiers: *Membrane compaction, Flux restoration, Membrane cleaning.

Laboratory investigations were carried out to determine the feasibility of (1) removing scale from cellulose acetate membranes that had been used for reverse osmosis demineralization, and (2) restoring the performance of compacted membranes by subjecting them to various regeneration treatments. Sodium hydrosulfite solutions and oxalic acid solutions at concentrations of 1-5 percent and 0.2 percent, respectively, were effective in cleaning the membrane without degrading it, but there was little subsequent improvement in membrane performance. On the other hand, membranes that had been subjected to accelerated compaction at 1,500 psi were effectively regenerated by simple soaking in hot water at temperatures approaching the values originally used in their production. Flux recoveries up to 60 percent were achieved with no net loss in salt rejection. (Mintz-Office of Saline Water)
W69-08395

MATHEMATICAL MODEL AND COMPUTER PROGRAM FOR SIMULATION AND OPTIMUM DESIGN OF VERTICAL TUBE EVAPORATION PLANTS FOR SALINE WATER CONVERSION,
Houston Research Inst., Inc., Tex.
C. J. Huang, H. M. Lee, and A. E. Duckler.
Int J Sci Technol Water Desalting, Vol 6, No 1, p 25-56, Apr 1, 1969. 32 p, 12 tab, 13 fig, 9 ref.

Descriptors: *Mathematical models, *Dynamic programming, *Simulation analysis, *Optimization, *Desalination, Evaporation, Design, Saline water, Capital, Evaporators, Size.
Identifiers: Module approach, Vertical tube evaporation, Gradient techniques.

The techniques of obtaining optimum design for a desalting plant were presented. The objective of the study was to develop a computer program for simulating and designing a multistage vertical tube evaporation falling film desalination plant, which could be constructed with a minimum capital investment, or which produced fresh water at the lowest cost possible. The 'module approach' was adopted for developing the complete system that was divided into four major subsystems. Dynamic programming was applied to optimize simultaneously tube size distribution and recirculation rate. The gradient searching technique was found to be most suitable for optimizing a continuous process. As an example, the application of the model, an optimum design of a saline water conversion plant with product rate of 50 million gallons fresh water per day was presented. It was demonstrated that for a specified production capacity an optimum design of a desalting plant can be directly and automatically generated by the programmed model and that the simulation and optimization system developed was reasonably general, versatile and flexible. (Thiuri-Cornell)
W69-08549

3B. Water Yield Improvement

WATER YIELD CHANGES AFTER CONVERTING A FORESTED CATCHMENT TO GRASS,
Forest Service (USDA), Tempe, Ariz. Forest Hydrology Lab.
A. R. Hibbert.
Water Resources Res, Vol 5, No 3, pp 634-64[illegible] June 1969. 7 p, 3 fig, 13 ref.

Descriptors: *Water yield improvement, *Clear cutting, *Evapotranspiration control, Evapotranspiration, Infiltration, Rainfall-runoff relationship, Forest management, Watershed management, Water management (Applied), Water harvesting.
Identifiers: Grassed watersheds.

A 22-acre catchment in the southern Appalachians was cleared of hardwood forest in 1958 and 195[illegible] and seeded to Kentucky 31 fescue grass in 195[illegible] and 1960. The amount of evapotranspiration by the grass cover was closely related to the amount of grass produced. During years when grass production was high, water yield from the catchment was about the same as or less than the expected yield from the original forest. As grass productivity declined, water yield gradually increased until it exceeded the predicted yield from the forest by over 5 inches annually. The grass appeared to evaporate more water early in the spring and less water late in the summer than the original forest cover. (Knapp-USGS)
W69-08200

ANTITRANSPIRANTS RESEARCH AND ITS POSSIBLE APPLICATION IN HYDROLOGY,
California Univ., Davis.
For primary bibliographic entry see Field 02D.
W69-08210

DROUGHTS IN FINNISH WATERCOURSES WITH REFERENCE TO WATER SUPPLY AND POLLUTION CONTROL (FINNISH),
Finnish Hydrological Office, Helsinki
For primary bibliographic entry see Field 02E.
W69-08254

A PRACTICAL FIELD TECHNIQUE FOR MEASURING RESERVOIR EVAPORATION UTILIZING MASS - TRANSFER THEORY,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02D.
W69-08418

INFLUENCE OF GAP WIDTH BELOW A VERTICAL SLAT SNOW FENCE ON SIZE AND LOCATION OF LEE DRIFT,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station
For primary bibliographic entry see Field 02C.
W69-08450

SOME OBSERVATIONS ON TEMPERATURE PROFILES OF A MOUNTAIN SNOW COVER
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station
For primary bibliographic entry see Field 02C.
W69-08451

PHYSICAL AND ECONOMIC DESIGN CRITERIA FOR INDUCED SNOW ACCUMULATION PROJECTS,
Forest Service (USDA), Laramie, Wyo. Rocky Mountain Forest and Range Experiment Station
Ronald D. Tabler.
Water Resources Research, 1968, 4 (3): 513-[illegible] Illus.

Descriptors: *Snow management, *Optimum development plans, *Cost-benefit analysis, *Pro-

y, Economic justification, Project planning, nomic feasibility, Evaluation, Economics, Pro- benefits, Snowpacks.
tifiers: *Snow fences.

w fencing promises to be an important means of easing surface water yield or ground water arge on windswept watersheds where snow is mportant form of precipitation. Assuming an ılly spaced series of snow fences, a physical luction function can be developed that relates e spacing to the 'most probable' annual snow h, based on a probability analysis of winter ipitation. The optimum scale of development rms of fence spacing, determined by standard ginal analysis, indicates that the smaller the ginal value of output with respect to inputs, the ter the probability must be of the fences filling ıally if net benefits are to be maximized.
9-08459

L MOISTURE RESPONSE TO SPRAYING SAGEBRUSH WITH 2, 4-D,
est Service (USDA), Laramie, Wyo. Rocky ıntain Forest and Range Experiment Station.
primary bibliographic entry see Field 02I.
9-08460

MMER WATER USE BY ASPEN, SPRUCE, O GRASSLAND IN WESTERN COLORADO,
est Service (USDA), Tempe, Ariz. Rocky ıntain Forest and Range Experiment Station.
primary bibliographic entry see Field 02I.
9-08468

ELIMINARY WATER YIELDS AFTER IBER HARVEST ON CASTLE CREEK, IZONA WATERSHEDS,
est Service (USDA), Tempe, Ariz. Rocky untain Forest and Range Station.
vell R. Rich.
z Watershed Symposium Proc (12) 1968, 9-12, s.

criptors: *Watershed management, *Forest nagement, *Water yield, Ponderosa pine trees, rs, Sampling, Slopes, Clear cutting, Water yield rovement.
ntifiers: *Even aged forest management, *Syste- ic sampling, Timber yields, Experimental ersheds, Aspect, Slopes, Litter.

liminary measurements indicate increased er yields following timber harvest on West Fork Castle Creek. Timber harvest treatment in- ded clear cutting one-sixth of the watershed in cks fitted to overmature and dwarf mistletoe in- ed tree classes. The remaining five-sixths of the ershed was placed in the best growing condition sible for the existing ponderosa pine stand.
9-08472

E WORKMAN CREEK EXPERIMENTAL TERSHED,
est Service (USDA), Tempe, Ariz. Rocky untain Forest and Range Experiment Station.
vell R. Rich, H. G. Reynolds, and J. A. West.
: River Valley Water Users Asso, published as DA Station pap, RM-65 (1961). 18 p.

criptors: *Demonstration watersheds, *Humid as, *Water yield, *Sedimentation, *Regression lysis, Riparian plants, Streamflow, *Water yield rovement.
ntifiers: *Moist site timber, Perennial grass, Ex- imental watersheds.

Workman Creek experimental watersheds lie ıin the humid forest type of central Arizona ut 50 miles north of Globe, Arizona. Of the e watersheds available, one is reserved as a trol to determine treatment effects on the other . The North Fork watershed is used to evaluate nges in water yield and sedimentation resulting n removing or changing cover types. The first treatment was a riparian cut to remove broadleaf trees along the stream channel. The second step was a moist site cut to remove and replace with perennial grass all trees growing on moist bottom sites. The riparian cut had no effect on streamflow, the moist cut after two years indicated nonsignificance for a year of below average streamflow and significance for a year of above average streamflow. South Fork is being managed for production of high quality timber and its effect on water and sediment yields. The first cut removed about 50% of the merchantable volume and was followed by an improvement cut. This timber harvest cut did not affect water yields.
W69-08473

WATER YIELDS RESULTING FROM TREATMENTS APPLIED TO MIXED CONIFER WATERSHED,
Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
Lowell R. Rich.
Arizona Watershed Symposium Proc (9) 1965, 12-15, illus.

Descriptors: *Water, *Mixed forests, *Regression analysis, Watershed management, *Water yield improvement, Coniferous forests.
Identifiers: *Riparian cut, *Moist site forest vegetation, Wildland watersheds, Management practices, Timber harvest, Experimental watersheds, Perennial grasses.

Removal of moist site forest vegetation along main stream channels and replacement with perennial grass have resulted in significant water yield increases. The adjusted increase would be 1.1 inches+ 0.3 inch at the 95 percent level: this increase averages 46 percent. A commercial timber harvest on an individual tree selection harvest did not significantly increase water yields. One problem for the future is to find a method of timber harvest that will increase water yields and produce a favorable tree cover for needed uses.
W69-08477

PRELIMINARY EFFECTS OF FOREST TREE REMOVAL ON WATER YIELDS AND SEDIMENTATION,
Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
L. R. Rich.
Arizona Watershed Sympos Proc (4) 1960, 13-16, illus.

Descriptors: *Demonstration watersheds, *Humid areas, *Streamflow, Sandstones, Loam, Clay loam, Clays, Mixed forests, Riparian plants, Precipitation, Sediments, Coniferous forests, Water yield improvment, sediment yield.
Identifiers: Quartizite, Diabase, Perennial grasses, Experimental watersheds.

Two management treatments are reported for the Workman Creek, Arizona watersheds. Elevations vary from 6,590 to 7,724 feet. Precipitation averages about 32 inches and streamflow about 3 1/2 inches. Mixed conifer vegetation dominates the area. A riparian cut (Arizona alder and big tooth maple) that removed 0.6 percent of trees on the 248 acre North Fork Watershed showed no significant increase in water yields. Following replacement of 80 acres of moist site (white and Douglas-fir) vegetation with perennial grass, the first two years of measured streamflow indicate one year of nonsignificance and one year of significantly increased water yield. Sediment yields increased during the first two years. This replacement treatment cost $379.00 per acre for clearing, windowing, slash burning, seeding, and initial suppression of sprouts.
W69-08478

WATERSHED TREATMENT EFFECTS ON EVAPOTRANSPIRATION,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 02D.
W69-08481

IMPROVING WATER YIELD AND GAME HABITAT BY CHEMICAL CONTROL OF CHAPARRAL,
Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
C. P. Pase, P. A. Ingebo, E. A. Davis, and C. Y. McCulloch.
Proc Int Union Forestry Res Organ XIV: 463-486. 1967.

Descriptors: *Water yield improvement, *Brush control, *Herbicides, *Deer, Chaparral, Wildlife habitats, Watershed management, Erosion, 2, 4, 5-T.
Identifiers: *Fenuron, *Picloram, Post-fire erosion.

Aerial and hand application of 2,4,5-T for 4 consecutive years held crown cover of chaparral fire sprouts to 12 percent, compared to 56 percent on unsuppressed fire sprouts. Water yield increases on a 38.6 ha. watershed averaged 76 mm. per year for the first 3 years. With high rainfall the fourth year, the increase was 250 mm. Chemical control resulted in higher forb and grass production and more deer use than on an adjacent untreated watershed. Hand application of fenuron or picloram to 6-year-old fire sprouts on northerly aspects and channel bottoms on a 18.8 ha. watershed reduced crown cover from 51 percent to 12 percent on the treated area. Water yield appears to be increasing, but data insufficient to draw firm conclusions. Shrub control on cool, more moist sites with interspersed escape cover on southerly aspects might favor deer habitat.
W69-08483

BURNED CHAPARRAL TO GRASS: EARLY EFFECTS ON WATER AND SEDIMENT YIELDS FROM TWO GRANITIC SOIL WATERSHEDS IN ARIZONA,
Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
Charles P. Pase, and P. A. Ingebo.
Ariz Watershed Symp Proc 9: 8-11, illus. 1965.

Descriptors: *Chaparral, *Brush control, *Water yield improvement, Accelerated erosion, Vegetation effects, Watershed management, Shrubs, Herbicides, Burning, Vegetation regrowth, 2-4-55-T.
Identifiers: *Post-fire erosion, Live oak, Experimental watersheds.

Annual spraying with 2,4,5-T following a wildfire in chaparral successfully held resprouting brush cover to less than 10 percent crown density and allowed establishment of a good grass cover. Compared to an adjacent watershed returning to brush cover, water yields increased significantly. Sediment yields increased immediately after the fire, and declined to near prefire levels within 5 years.
W69-08485

HELICOPTER-APPLIED HERBICIDES CONTROL SHRUB LIVE OAK AND BIRCHLEAF MOUNTAINMAHOGANY,
Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
C. P. Pase.
US Forest Serv Res Note RM-84. 4 p, illus. 1967.

Descriptors: *Brush control, *Herbicides, Chaparral, *2-4-5-T, Shrubs, 2-4-D.
Identifiers: Helicopter, Aerial spray, Live oak, Mountainmahogany.

Four annual helicopter applications of 2,4,5-T to fire sprouts of chaparral held shrub live oak and birchleaf mountainmahogany cover to less than 5 percent, while unsprayed sprouts increased to 21 percent. No difference was found between emulsifiable and invert forms of 2,4,5-T, and 1:1 mixtures of oil soluble 2,4,5-T and 2,4-D. PBA and TBA were substantially less effective in retarding shrub growth.
W69-08486

LIBRARY U. OF I., URBANA-CHAMPAIGN

PERPETUAL SUCCESSION OF STREAM-CHANNEL VEGETATION IN A SEMIARID REGION,
Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
C. J. Campbell, and Win Green.
J Ariz Acad Sci Vol 5, No 2, p 86-98, Oct 1968.

Descriptors: *Riparian plants, *Succession, Distribution patterns, Ecology, Cottonwoods, Mesquite, Riparian water loss, Vegetation, Elevation.
Identifiers: *Riparian hardwoods, Sycamore.

The community aspects of channel vegetation with respect to changing elevation on Sycamore Creek, Maricopa County, Arizona were studied by means of 402 stratified random, 0.05-acre quadrats to determine shrub and tree composition, and 150 permanently located 9.6-square-foot quadrates to determine grass and forb composition. Ninety-five percent of the shrub species sampled and approximately 50 percent of the tree species are indigenous to the semiarid mountain slopes, and are not dependent upon additional subsurface moisture in the channel for survival. The true riparian species exist only where additional subsurface moisture is available in addition to annual precipitation. Riparian species are found along the stream channel in a relatively narrow band that sometimes bisects sharply demarked vegetational zones. The channel vegetation probably never reaches a climax hierarchy due to periodic flood disturbances such as erosion, inundation, and deposition. As a result, mosaics of various seral stages with different dominant species characterize the vegetation communities.
W69-08489

WATER TABLE CHARACTERISTICS UNDER TAMARISK IN ARIZONA,
Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
Howard L. Gary, and C. J. Campbell.
USDA Forest Serv Research Note RM-58, 7 p, Nov 1965.

Descriptors: *Water table, *Tamarisk, *Evapotranspiration, *Water loss, Consumptive use, Transpiration riparian plants, Riparian water loss.

Water-table characteristics under Tamarix pentandra in central Arizona are described. Water-table fluctuations in 39 ground-water wells within a circular area of about 40 feet in diameter are discussed before and after vegetation removal. Pumping tests to simulate natural diurnal fluctuations in selected wells were not satisfactory. ET losses were not determined.
W69-08490

GUIDE FOR SURVEYING PHREATOPHYTE VEGETATION,
Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
J. S. Horton, T. W. Robinson, and H. R. McDonald.
For sale by Sub Dec USGPO for 20 cents. U S Dep Agr, Agr Handbook, No 266, May 64. 37 p, illus.

Descriptors: *Vegetation, Surveys, *Aerial photography, *Phreatophytes, *Statistical methods, Tamarisk, Riparian plants, Playas, Flood plains, Water loss, Riparian water loss, Evapotranspiration, Vegetation effects.
Identifiers: Vegetation surveys.

In the arid and semiarid region of the western United States, water losses from stream channels, flood plains, bottom lands, and delta areas by evapotranspiration are serious. In spite of water losses and creation of additional flood hazards, vegetation growing along streams or on flood plains may have considerable economic value for recreational use, grazing, wildlife, or flood control. To properly manage bottom-land and streambank areas and to evaluate the overall effects of vegetation treatments, surveys are needed to determine the kinds of plants present in the existing stands, the relative importance of component species, and such characteristics of the vegetation as percentage of the ground covered by living plants, average height and crown thickness of the trees and shrubs, and the amount of understory vegetation. An economic sampling scheme that can be repeated and will yield data precise enough to be reliable is described.
W69-08491

OBSERVATIONS OF SNOWPACK ACCUMULATION, MELT, AND RUNOFF ON A SMALL ARIZONA WATERSHED,
Forest Service (USDA), Flagstaff, Ariz. Rocky Mountain Forest and Range Experiment Station.
Peter F. Ffolliott, and Edward A. Hansen.
USDA Forest Serv Res Note RM-124, 1968. 7 p.

Descriptors: *Snowpacks, *Runoff, *Snowmelt, Streamflow, Overland flow, Elevation, Coniferous forests, *Water field improvement, Ponderosa pine trees, Forest management, *Watershed management.
Identifiers: *Experimental watersheds.

Intensive measurements of snow and streamflow on a 425-acre ponderosa pine watershed indicated that more than 90 percent of the snowpack left the watershed as runoff. Snow accumulation was inversely related to forest density, which indicates a possible opportunity for increasing snow accumulation through more intensive forest management.
W69-08493

OBSERVATIONS OF SNOW ACCUMULATION AND MELT IN DEMONSTRATION CUTTINGS OF PONDEROSA PINE IN CENTRAL ARIZONA,
Forest Service (USDA), Flagstaff, Ariz. Rocky Mountain Forest and Range Experiment Station.
Edward A. Hansen, and Peter F. Ffolliott.
USDA Forest Serv Res Note RM-111, 1968. 12 p.

Descriptors: *Snowmelt, *Snowpacks, Coniferous forests, *Water yield improvement, Timing, Snow cover, Ponderosa pine trees, *Watershed management, Forest management, Clear-cutting, Water loss.
Identifiers: *Experimental watersheds.

A clearcut block on a north aspect and strips with widths of one and one-and-one-half times tree height on an east aspect increased snow accumulation and increased rates of melt and daily water loss. A strip three-fourths as wide as tree height on a west aspect increased snow accumulation. None of the strips cut on south and southwest aspects affected snowpacks measurably.
W69-08494

POSSIBILITIES OF INCREASING STREAMFLOW FROM FOREST AND RANGE WATERSHEDS BY MANIPULATING THE VEGETATIVE COVER--THE BEAVER CREEK PILOT WATERSHED EVALUATION STUDY,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
Raymond Price.
Inter Union Forest Res Organ XIV. IUFRO-Kongress, VI, Sect 01-02-11, 1967. p. 487-504.

Descriptors: *Water field improvement, *Vegetation effects, *Watershed management, Runoff, Forest management, Coniferous forests, Ponderosa pine trees, Pinyon pine trees, Soil-water-plant relationships.
Identifiers: *Experimental watersheds, Pinyon-juniper.

Increasing population, agricultural activity, and industrial development call for increased water supplies in many parts of the world. One possibility of increasing streamflow is through manipulating vegetative cover on watersheds. The Beaver Creek pilot watershed in north-central Arizona has been designed to evaluate possibilities of incre
water yields by modifying vegetative cover. Ev
tions are made in terms of other multiple-use
products as well as water and also in econ
terms. Studies are underway to lower pinyo
niper woodland, upper pinyon juniper wood
and ponderosa pine forest types. Precipitatio
ries from 13 to 25 inches in the lower woo
type, from 14 to 30 inches in the upper woo
type, and from 15 to 43 inches in the pine
type. Eighteen small watersheds have
delineated and instrumented. Each has been
toried with respect to soil, timber, forage, an
dlife habitat as well as streamflow. First treat
tested have been drastic measures such as com
removal of trees. Subsequent treatments ar
severe. This project involves original wo
design, instrumentation, and other methodolo
is closely coordinated with economics rese
and economic principles are considered in
ning studies and results of treatments ca
analyzed in economic terms. (Lloyd-USDA
Service)
W69-08495

**MANAGING CALIFORNIA'S SNOW
LANDS FOR WATER,**
Forest Service (USDA), Berkeley, Calif. P
Southwest Forest and Range Experiment Stati
Henry W. Anderson.
US Forest Service Research Paper PSW-6 (1
1-28.

Descriptors: *Snow management, *Wate
management, *Snowmelt, *Water yield imp
ment, *Flood control, *Sediment discharge,
management, Brush control, Topogr
Coniferous forests, California.
Identifiers: Forest patterns, Timber ha
Logging.

The hydrology of California's snow zone as
fects management for improved water yield is
marized. Broad sources of water yield, varia
and distribution are briefly reviewed. The effe
forests on the processes of snow accumulatio
melt and soil moisture are assessed, and the
of both theoretical evaluations and practica
are brought together to indicate the effe
forest management alternatives on water
Suggested prescriptions for management of f
for water production and control in different
conditions and sites are outlined.
W69-08498

**INTEGRATING SNOW ZONE MANAGE
WITH BASIN MANAGEMENT,**
Forest Service (USDA), Berkeley, Calif.
Southwest Forest and Range Experiment Stat
Henry W. Anderson.
Water Research (1966): 355-373, The John
kins Press: Baltimore.

Descriptors: *Snow management, *Wat
management, *Hydrologic budget, *Snow
*Snowdrifts, *Evaluation, Brush, Forest m
ment, Alpine, Mountains, Methodology, Re
facilities, Computer models, Colorado, Cali
Water yield improvement.
Identifiers: Hydrologic potential, Forest pa
Timber harvest, Type conversion.

Snowpacks are managed by controlling snow
mulation, snowmelt, and evaporation; the
melt water is further managed by con
vegetation-induced losses--interception anc
piration--by controlling evaporation from s
water surfaces, by modifying the retention
teristics of the soil 'reservoir,' and by modify
surface and subsurface paths that the water
its runoff. This paper summarizes some
present techniques and what they can acco
and points out how water management can
place in basin management. The role of cu
forest, brushland conversion, and artifici
barriers in management for water supply a
trol is illustrated with results from Colora

lifornia. Tentative criteria are suggested for sign of forest cuttings for particular objectives of ter yield improvement, flood prevention, and iment control. Further studies are suggested, h of physical applications to forest sites and of praisals methods which will allow the integration physical knowledge in the design of systems of in management.
69-08503

RESTS -- USERS OF WATER,
rest Service (USDA), Berkeley, Calif. Pacific uthwest Forest and Range Experiment Station.
G. Dunford.
oceedings, Society of American Foresters, 1966: 6-150.

scriptors: *Watershed management, *Consumpe use, *Water yield improvement, *Evapotransation, *Interception, Forests, Streamflow, anspiration, Evaporation, Throughfall, Stemw, Root zone, Soil moisture, Snow management, parian water loss, Forest management, Clearting.
ntifiers: *Multiple-use management.

e author gives a partial survey and summary of state of knowledge about uses of water by rests, and points out gaps in knowledge of the mplex physical factors involved. Future needs intensive and intelligent multiple-use manageent of forested watersheds require that we velop more precise means of measuring the invidual sources of moisture use and learn more out how these processes function.
69-08512

C. Use of Water of Impaired Quality

ATER REUSE IN MONTERREY, MEXICO,
elulosa y Derivados S.A., Monterrey (Mexico).
opropiedad Grupo Quimico.
or primary bibliographic entry see Field 05D.
69-08289

ASTEWATER REUSE AT THE GRAND ANYON,
rizona State Dept. of Health, Phoenix.
or primary bibliographic entry see Field 05D.
69-08290

FFECTS OF EXTERNAL SALT CONCENTRAIONS ON WATER RELATIONS IN PLANTS: . THE COMPENSATION OF OSMOTIC AND YDROSTATIC WATER POTENTIAL DIFERENCES BETWEEN ROOT XYLEM AND XTERNAL MEDIUM,
alifornia Univ., Riverside. Dept. of Soils and Plant utrition.
or primary bibliographic entry see Field 02I.
69-08291

HE APPLICATION OF GEOELECTRICAL ETHODS FOR GROUND-WATER EXPLORAION OF UNCONSOLIDATED FORMATIONS N SEMI-ARID AREAS,
agreb Univ. (Yugoslavia). Geophysical Inst.
or primary bibliographic entry see Field 07B.
69-08297

ROUND WATER OF THE WESTERN DESERT N IRAQ,
aghdad Univ. (Iraq). Dept. of Geology.
bbas Ihsan Baghdadi.
ternat'l Assoc Hydrogeol, Congress of Istanbul, 967, Memoir 8, pp 525-532, 1968. 8 p, 4 pl, 3 ref.

escriptors: *Aquifer characteristics, Arid lands, rid climate, Depression storage, Drainage patrns (Geologic), Geomorphology, Playas, Topogphy, Valleys, Limestones, Deep wells, Fractures (Geologic), Geohydrologic units, Groundwater basins, Shallow wells, Springs, Watertable, Saline water, Hardness (Water), Alkalinity, Nitrates, Sulfates, Chlorides, Carbonates.
Identifiers: *Western Desert, *Iraq.

The little varied topography and dominate geologic features of the Western Desert of Iraq are described under 5 geographical subdivisions; Al Hamad Plain, Upper Wadian, Al Hajara Plain, Lower Wadian and Dibdibba Plain. In the south the watertable is present at a shallow depth, but in the north it is at relatively deep levels. Generally the shallow wells obtain water from valley gravels and sands, while deep wells depend on fractured limestone and porous limestone. Drilled or hand dug wells are located in playas, depressions and valley beds. Low rainfall accompanied by high evaporation result in almost no recharge, an important factor in considering exploitation of groundwater resources of this area. The geographic occurrence of 5 types of water are noted; sulphate predominant mixed saline, chloride predominant mixed saline, nitrate, carbonate and alkaline. Water in valley gravels and sands is medium hard, while that in fractured limestone is very hard. Yield, chemistry and temperature are noted for springs. (Sherbrooke-Ariz)
W69-08298

SEASONAL VARIATION IN ALKALINITY IN PANS IN CENTRAL AFRICA,
Leicester Univ. (England). Dept. of Zoology.
J. S. Weir.
Hydro-Biologic, Vol 32, No 1/2, pp 69-80, 1968. 12 p, 8 fig, 11 ref.

Descriptors: *Alkalinity, *Seasonal, Ions, Groundwater, Hydrogenion concentration, Bicarbonates, Hardness (Water), Water analysis, Aeolian soils, Sands, Game management, Dry seasons, Annual, Wet seasons.
Identifiers: *Pans, *Central Africa, Rhodesia, Kalahari sand deposits, Wankie National Park.

This paper considers seasonal variation of pH and alkalinity of 65 pans in semi-arid Central Africa. Several types of pans were considered: natural semi-permanent or occasionally permanent, semipermanent showing human influence, deepened permanent, and pumped permanent. pH of natural pans ranged from 6.1 to 8.7 and total alkalinity from 10 mg/1. to 580 mg/1. Variation was attributed to local soil differences. Natural pans reached their maximal size in Jan. or Feb., the rainy season, and showed maximal alkalinity and pH in Aug./Sept. (no rain since April) or in Nov. after the first rains partially filled the pans. Seasonal variation of alkalinity and pH in semi-permanent human influenced and deepened permanent pans followed the pattern of natural pans. 'Pumped' pans were all alkaline with large values of total alkalinity. This was attributed to the nature of the borehole water pumped and period of pumping. There is no correlation between variations in the numbers of game animals recorded at pans with differences in bicarbonate alkalinity. Fish, turtles or insects living either in permanent or temporary pans have to withstand a wide range of alkalinity fluctuation during the year. (Sherbrooke-Ariz)
W69-08301

SALT BUILD-UP FROM SEWAGE EFFLUENT IRRIGATION,
Utah State Univ., Logan. Dept. of Irrigation.
For primary bibliographic entry see Field 05D.
W69-08618

3E. Conservation in Industry

THE USE OF RESERVOIRS AND LAKES FOR THE DISSIPATION OF HEAT,
Geological Survey, Washington, D. C. Water Resources Div.
For primary bibliographic entry see Field 05C.
W69-08406

3F. Conservation in Agriculture

STOMATAL INFILTRATION MEASUREMENTS AS AN INDICATOR OF THE WATER REQUIREMENT AND TIMING OF IRRIGATION FOR COTTON,
National and Univ. Inst. of Agriculture, Rehovoth (Israel).
M. Ofir, E. Shmueli, and S. Moreshet.
Expl Agric, Vol 4, pp 325-333, 1968. 9 p, 8 fig, 11 ref.

Descriptors: *Stomata, *Irrigation efficiency, Infiltration, Moisture availability, Water utilization, Crop response, Epidermis, Irrigation effects, Transpiration, Soil-water-plant relationships, Water conservation, Water requirements, Water utilization efficiency, Cotton, Timing.
Identifiers: Israel.

Experiments with several liquids, leaf positions and times of measurement lead to the development of a single-liquid infiltration method of measuring stomatal opening. Tests showed that use of a 2:1 turpentine-parafin oil mixture on the lower surface of the fifth to seventh leaf between 1200 and 1400 hrs. would give a practicle field method of setting cotton irrigation schedules. The infiltration index (determined from stomatal infiltration) was independent of changes in soil moisture conditions above 30-35% available soil moisture, but below this point (range of inflection) the index was very sensitive to soil moisture changes. An irrigation treatment was designed to prevent soil moisture from falling below that of the inflection range. Field test resulted in significantly greater yields from stomata infiltration scheduled irrigation. The practicle applicability of the method is discussed. (Sherbrooke-Ariz)
W69-08293

WATER RELEASE AS A SOIL PROPERTY RELATING TO USE OF WATER BY PLANTS,
California Univ., Riverside.
Sterling J. Richards.
Tran, Amer Soc of Agric Engineers, Vol 11, No 1, pp 74-75, 1968. 2 p, 4 fig, 5 ref.

Descriptors: *Moisture availability, Irrigation practices, Retention, Soil aggregates, Soil classification, Soil horizons, Soil structure, Field capacity, Wilting point, Tensiometers, Water storage, Moisture tention, Sudangrass, Water-plant relationships, Soil mechanics.
Identifiers: *Water-release curves, Resistance block.

The volume fraction of soil water released to growing plants is proposed as a soil property for comparing soils or evaluating structural changes in a soil. Water release is measured as a function of soil suction, utilizing a tensiometer and a resistance block. A procedure utilizing soil containers and Sudangrass is detailed. Because most field situations present various soil horizons and rooting characteristics of crops soil-water depletion varies with depth, it is recommended that tensiometers or blocks be used in each recognized soil horizon and separate water release curves be drawn. Total irrigation water depth would be the sum of all the horizons. Examples of water-release curves are given for three soils with widely varing textures. Two soils in spite of wide differences in texture had almost identical water-release curves. Treatment of one soil with an aggregating agent, VAMA, resulted in a marked increase in water release. Water release curves appear to have advantages over other procedures for evaluating the property of a soil to store water for plant use. (Sherbrooke-Ariz)
W69-08302

WATER ECONOMY OF AGAVE SISALANA UNDER DESERT CONDITIONS,
National Research Centre, Cairo (Egypt).
A. A. Abdel Rahman, A. M. El Gamassy, and M. S. Mandour.

Flora Abt B. Morphol Geobot (Jena), Vol 157, No 3, pp 355-378, 1967-68. 24 p, 11 fig, 13 ref.

Descriptors: *Drought resistance, *Irrigation effects, Climatic data, Transpiration, Water balance, Osmotic pressure, Plant physiology, Drought tolerance, Resistivity, Salt tolerance, Root development, Root distribution, Stomata, Turgidity, Arid lands, Water requirements, Xerophytes, Desert plants, Coastal marshes, Dunes.
Identifiers: *Agave Sisalana, United Arab Republic.

Two-year studies on plants growing naturally, plants continuously irrigated and plants irrigated only in summer were completed at two different habitats, inland desert and coastal sand dunes. All agaves planted at a salt marsh died. Hourly, monthly and seasonal changes for transpiration rate, relative turgidity, and osmotic pressure are related to environmental conditions and irrigation treatment. The results demonstrate the extreme drought resistance of this plant. Annual transpiration intensity was an extremely low 43 mg./g./h. Moderate osmotic pressure max. 29.3 atm., was reached under adverse conditions. Uprooted plants afforded a saturation deficit of up to 50% in three months, without losing their vitality. Succulence provided agaves with resistance to long dry rainless periods. Roots remained in the upper 50 cms. of soil under all treatments, deeper water being unavailable to them. Plants under irrigation exhibited longer active growth periods and were more vigorous. (Sherbrooke-Ariz)
W69-08303

NET LOSSES IN SPRINKLER IRRIGATION,
Technion - Israel Inst. of Tech., Haifa.
Ido Seginer.
Agr Meteorol (Amsterdam), Vol 4, No 4, pp 281-291, July, 1967. 11 p, 5 fig, 5 tab, 7 ref.

Descriptors: *Sprinkler irrigation, *Water loss, Deserts, Crop yield, Evaporation, Evapotranspiration, Soil moisture, Water utilization efficiency, Irrigation efficiency, Application methods, Timing.
Identifiers: *Net water losses, Israel.

This study estimated the difference between gross water losses and net water losses under sprinkler irrigation of corn in Israel in an attempt to evaluate the significance of published gross water loss data. Net losses were defined as the difference between the consumptive use of water of the sprinkle irrigated crop and the normal evapotranspiration of the unsprayed crop. Irrigation intervals of 3 days and 2 weeks were used with each method. Water quantities were equal. Soil moisture and dry weight yield were determined. No significant differences were exhibited between treatments, except the overhead sprinkling-3 day intermal treatment. This consumed 10% more water than the others (significant at 0.1 level). Gross spray losses of 30% have been cited in the literature for desert areas. More realistic values for large fields under normal agricultural practices and arid conditions would be 15-20%. However, net losses are not expected to rise at a similar rate, as increased gross losses replace increased evapotranspiration during irrigation, thus maintaining a relatively low level of net losses. (Sherbrooke-Ariz)
W69-08305

RENOVATION OF WASTE WATER THROUGH APPLICATION TO AGRICULTURAL CROPLAND AND FORESTLAND,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
For primary bibliographic entry see Field 05D.
W69-08377

EVAPOTRANSPIRATION BY IRRIGATED CORN,
Agricultural Research Service, Thorsby, Ala. Soil and Water Conservation Research Div.; and Alabama Agricultural Experiment Station, Auburn.
For primary bibliographic entry see Field 02D.
W69-08428

EFFECT OF MOISTURE REGIME AND STAGE OF PLANT GROWTH ON MOISTURE USE BY COTTON,
Agricultural Research Service, Thorsby, Ala. Soil and Water Conservation Research Div.; and Alabama Agricultural Experiment Station, Auburn.
For primary bibliographic entry see Field 02D.
W69-08430

WARM-WATER IRRIGATION: AN ANSWER TO THERMAL POLLUTION,
Eugene Water and Electric Board, Oreg.
For primary bibliographic entry see Field 05C.
W69-08561

EFFECTS OF HURRICANE STORMS ON AGRICULTURE,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 02B.
W69-08568

MUNICIPAL SEWAGE EFFLUENT FOR IRRIGATION.
Louisiana Polytechnic Inst., Ruston. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05D.
W69-08615

SOIL RESPONSE TO SEWAGE EFFLUENT IRRIGATION,
Robert S. Kerr Water Research Center, Ada, Okla.
For primary bibliographic entry see Field 05D.
W69-08616

CROP RESPONSE TO SEWAGE EFFLUENT,
Pennsylvania State Univ., University Park. Dept. of Soil Technology.
For primary bibliographic entry see Field 05D.
W69-08617

PRACTICAL IRRIGATION WITH SEWAGE EFFLUENT,
For primary bibliographic entry see Field 05D.
W69-08619

THE MOVEMENT OF DISEASE PRODUCING ORGANISMS THROUGH SOILS,
California Univ., Davis, Dept. of Civil Engineering.
For primary bibliographic entry see Field 05D.
W69-08621

A TECHNICAL AND ECONOMIC FEASIBILITY STUDY OF THE USE OF MUNICIPAL SEWAGE EFFLUENT FOR IRRIGATION,
Soil Conservation Service, Searcy, Ark.; and Louisiana Polytechnic Inst., Ruston. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05D.
W69-08623

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

FLOOD CONTROL AND SOIL CONSERVATION.

NY County Law sec 223 (McKinney 1950), as amended, (Supp 1968).

Descriptors: *New York, *Flood control, *S conservation, Administrative decisions, Admi trative agencies, Local governments, Proje Legislation, Legal aspects, Flood protection, E sion, Costs, Eminent domain, Compensation, Ea ments, Right-of-way, Project planning, Project p poses.

Each board of supervisors shall have power to propriate and expend county funds for the prot tion of property within the county from floods for the conservation of soil from erosion. A resolution in this regard adopted by a board sh include: (a) a statement of purpose and area of county involved, (b) the name of any waterway be improved, (c) the nature of the improveme (d) whether necessary easements, or other neces ry rights have been obtained and any compensati agreed to be paid, (e) whether it is necessary acquire any easements or right-of-way, (f) the e mated cost of such improvement, (g) whether penditures are to be financed under the lo finance law, (h) whether work will be done county employees, (i) what portions of the i provements are to be maintained by the cou and, (j) reference to a survey or plans of such i provement. Within 10 days after adoption of su resolution, notice of a public hearing thereon sh be given. After the hearing the board of supervis may adopt a final resolution providing for the va ous details necessary to commence the proje (Carruthers-Fla)
W69-08130

PATUXENT RIVER WATERSHED.
For primary bibliographic entry see Field 06E.
W69-08147

PATUXENT RIVER WATERSHED.
For primary bibliographic entry see Field 06E.
W69-08148

WATERSHED PROTECTION AND FLOO PREVENTION.
Vt Stat Ann tit 10, secs 631-636 (1958). amended, (Supp 1968), 637-641 (Supp 1968).

Descriptors: *Vermont, *Flood contr *Drainage, *Flood protection, Channel impro ment, Dams, Dikes, Diversion, Federal gove ment, State governments, Local governmer Legislation, Erosion control, Flood-proofing, Fl control, Multiple-purpose projects, Water poli Water law, Flood routing, Floods, Streams, Ban Stream flow, Administrative agencies, Citi Eminent domain.

The governor may employ any means to avert flo damage. The soil conservation districts are e powered to act under Public Law 566 to carry programs of flood control, streambank protecti channel improvement and land drainage. A m nicipality may acquire land for the purpose of c structing improvements for flood prevention un federal law. The Water Conservation Board is e powered to enter into contracts for the constr tion of dams, structures for streamback protect and channel improvement. The board may pay to 100 percent of the non-federal costs un Public Law 566 for flood prevention, recreat and storage for streamflow augmentation board may petition the county court of any cou to determine whether necessity requires the stat acquire land within the county for flood con projects. Necessity will be determined by adequacy of other locations, the nature of the la convenience to the land owner and the effect recreation, wildlife, municipal revenue and timl The board shall pay just compensation for the l taken and may enter the land for inspections surveys. (Helwig-Fla)
W69-08150

DRAINAGE DISTRICTS UNDER 1911 ACT.
SC Code Ann secs 18-231 thru 18-246 (1962)

iptors: *South Carolina, *Drainage districts, inistrative agencies, *Surveys, Legislation, aspects, Water policy, Jurisdiction, Financ- rainage, Civil engineering, Data collections, ng, Damages, Costs, Investigations, Judicial ons, Assessments, Evaluation, Value, Proper- ues, Public benefits, Watercourses (Legal), ads.

a drainage district is established, a complete of the drainage district shall be made by the er and viewers. The survey shall include the f each ditch, drain or levee, the location of main drain and its laterals, and the course and ce of each ditch, as well as, all other ap- ate marks and measurements relevant to the ge district. From this information a map shall mpiled. The engineers and viewers shall clas- e land according to the benefit it will receive he construction of levees, ditches, and water- es. Land shall be assessed according to this ication. The viewers shall confer with rail- company officials when any watercourses cross a railroad easement. In the event the rees cannot agree, the viewers may designate ace and manner of crossing and fix damages. ngineers and viewers must make final reports otices of same on all actions taken by them ch reports must be filed with the clerk of the These reports are subject to review and ap- on motion of landowners affected thereby. son-Fla)
08152

TAL CANDY CO INC V CITY OF MONT- ER (FLOOD DAMAGE FROM DRAINAGE EM).
imary bibliographic entry see Field 06E.
08176

ICIPAL PUBLIC WORKS.
de Ann secs 59-151, 59-152 (1962).

iptors: *South Carolina, *Pipelines, *Naviga- ters, *Highways, Cities, Water supply, Pipes, ation, Drainage, Legal aspects, Legislation, distribution (Applied), Water works, nbeds, Competing uses, Beds under water, s, Drainage systems, Utilities.
fiers: *Nontidal waters.

ity or person may lay pipes for water supply mmunity on or under any nontidal navigable n and, with county approval, on or under any y highway. The pipes cannot interfere with ation of the stream or free use of the highway. ne laying such pipes must keep them in repair. erence with any public waterworks, sewerage, ainage constitutes a misdemeanor. (Breeze-

08178

IC WORKS AUTHORIZED UNDER ARTI-

de Ann sec 59-365 (1962).

iptors: *South Carolina, *Cities, *Utilities, slation, Water works, Water supply, Sewers, Docks, Drainage systems, Legal aspects, benefits, Public health, Recreation, Public es, City planning, Municipal wastes, Water rces development, Parks, Recreation facili-

South Carolina municipality may purchase or ruct the following public works: waterworks n, water supply system, sewer system, piers, , drainage system, and public recreation (Breeze-Fla)
08179

ISSIPPI WATER RESOURCE CON- NCE - 1969.
sippi State Univ., State College. Water rces Research Inst.
imary bibliographic entry see Field 02E.

W69-08221

FLOOD PLAIN INFORMATION OF BARDEN CREEK, CASPER, WYOMING-VOLUME 1.
Corps of Engineers, Omaha, Nebr.

Prepared for the city of Casper. Corps Eng Flood Plain Rep, Feb 1969. 18 p, 2 photo, 3 plate, 2 tab.

Descriptors: *Floods, *Flood damage, *Wyoming, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Casper (Wyo), Standard project flood, Intermediate regional flood.

Flooding of Garden Creek, Casper, Wyoming is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-08224

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN GEORGIA.
Corps of Engineers, Atlanta, Ga. South Atlantic Div.

Corps Eng Water Resources Develop Rep, Jan 1969. 59 p, 4 fig, 47 photo, 1 map, index.

Descriptors: *Water management (Applied), *Georgia, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U.S. Army Corps of Engineers projects (Ga).

U.S. Army Corps of Engineers water resources development projects in Georgia are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-08225

FLOOD PLAIN INFORMATION OF NORTH FORK OBION RIVER, HOOSIER AND GROVE CREEKS, UNION CITY, TENNESSEE.
Corps of Engineers Memphis, Tenn.

Corps of Eng Flood Plain Rep, Nov 1968. 63 p, 9 fig, 21 plate, 16 tab.

Descriptors: *Floods, *Flood damage, *Tennessee, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Union City (Tenn), Standard project flood, Intermediate regional flood.

Flooding of the North Fork Obion River, Hoosier Creek, and Grove Creek, Union City, Tennessee, is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-08247

MICHALKA V GREAT NORTHERN PAPER COMPANY (FLOOD DAMAGE).

116 A2d 139-144 (Me 1955).

Descriptors: *Maine, *Flood damage, *Ice jams, Dams, Flooding, Flood control, Floodgates, Floodwater, Ice breakup, Riparian land, Riparian rights, Natural flow doctrine, Alteration of flow, Obstruction to flow, Legal aspects, Water law.
Identifiers: Lower riparian owner.

In the trial court, the lower riparian owner had a jury verdict in an action against a dam owner for damage due to flooding. The defendant dam owner excepted to the findings of the jury and the Supreme Judicial Court of Maine sustained those exceptions. The court held that the evidence did not sustain a proximately causal connection between the dam owner's release of water at the dam and the flooding, but instead compelled a finding that the efficient cause of the flooding was the formation of an ice jam below the property of the lower riparian owner. In so holding the court observed that a dam owner could lawfully permit water to pass over its dam in such quantities as water was flowing into the lake above the dam. (Carruthers-Fla)
W69-08318

CONSTRUCTION AND REPAIR OF BRIDGES AND DRAINAGE SYSTEMS.

Minn Stat Ann, secs 106.271, 106.471 (1947).

Descriptors: *Minnesota, *Bridges, *Drainage systems, *Local governments, Engineering structures, Abutments, Bridge construction, Civil engineering, Culverts, Bridge design, Repairing, Ditches, Taxes, Assessments, Legal aspects, Benefits, Legislation, Financing, Costs.

This statute provides for the construction, maintenance and repair of bridges and culverts on roads or rights of way. The method of financing such structures is defined and the method of assessing costs set out. Upon completion of any private bridge or culvert on any ditch system it shall be maintained and repaired by the county. Any drainage system shall be inspected annually and repaired as necessary in accordance with existing regulations. Interested or affected persons may petition the proper authorities for repair of any drainage system. There shall be an inspection, hearing and a report before repairs shall be made to any system. The procedure for determining and levying a benefit assessment arising from the construction of any drainage system is explained. (Helwig-Fla)
W69-08320

GAINESVILLE STONE CO V PARKER (DAMAGE TO LAND BY FLOODING CAUSED BY IMPROPER DAM MAINTENANCE).
165 SE2d 296-300 (Ga 1968).

Descriptors: *Georgia, *Dams, *Flood damage, *Streams, Legal aspects, Judicial decisions, Floods, Spillways, Dam failure, Dam construction, Damages, Impoundments, Overflow, Water levels, Impounded waters, Rock excavation, Quarries, Residual soils, Silts, Livestock, Soils, Remedies, Farms, Adjudication procedure, Maintenance.
Identifiers: Evidence, Injunction (Mandatory).

Plaintiffs were landowners adjoining land on which the defendants operated a stone quarry and crushing business. Defendants had constructed a dam for impounding water from a stream which ran through plaintiffs' land. The plaintiffs brought this action seeking damages and injunctive relief, alleging that the defendants had raised the height of the dam and spillway which caused the water to flood plaintiffs' property and render it useless. A jury returned a verdict for the plaintiffs. The court dismissed a procedural claim by the plaintiffs which would render the case unappealable and held that the appeal could be taken. The court held a witness ex-

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perienced in building dams was competent to testify to the flooding which will occur if a spillway is stopped up. The court further held that a witness was competent to testify to the value of the land if, although not an expert on land value in the area, he is at least familiar with such values. The court held that all testimony given as to the value of the land was admissible and that the lower court was correct in denying the defendants' motion for a new trial. (Shevin-Fla)
W69-08323

PARISH OF EAST BATON ROUGE V BARBAY (COMPENSATION FOR PROPERTY TAKEN FOR DRAINAGE CANAL CONSTRUCTION).

220 S0 2d 767-769 (La Ct app 1969).

Descriptors: *Louisiana, *Drainage, *Canals, *Eminent domain, Legal aspects, Judicial decisions, Condemnation, Drainage engineering, Ditches, Surface waters, Public benefits, Compensation, Condemnation value, Damages, Natural streams, Construction, Flow augmentation.
Identifiers: Natural drainage.

The Parish of East Baton Rouge, as plaintiffs, sought to appropriate a strip of defendant's property for the construction of a drainage canal. The defendant challenged the compensation offered to him. The lot was originally crossed by a natural drain that filled during rainfall. The Parish had previously dug out this natural drain to allow the water to flow away so that at the time of this suit, the lot was crossed near its center by a small, meandering ditch. The trial court had accepted the testimony of the plaintiffs' expert witness as to the value of the land and held the compensation of $1,685 to be proper. The appellate court held that since the testimony of the plaintiffs' expert on land values had not been rebutted the trial court's determination would be upheld. The court rejected the defendant's contention that the canal construction would damage his remaining property and refused to allow him any further compensation based on this claim. The court held that the trial court's determination constituted a just and adequate compensation for the land taken and affirmed the decision of the lower court. (Shevin-Fla)
W69-08324

CONSERVATION OF WATER.

Md Ann Code Art 25, sec 168 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Water conservation, *Water utilization, Administrative agencies, Administrative decisions, Legislation, Legal aspects, Regulation, Cities, Municipal water, Water supply, Water shortage, Local governments, Water allocation (Policy), Water distribution (Applied), Water requirements.
Identifiers: Raw water, Water engineer.

Whenever a request to restrict the use of water furnished by the mayor and city council of Baltimore in certain counties is made by the water engineer, then the county commissioners of certain counties are authorized to restrict the use of such water to any person or property located in such counties: (1) to the same extent as restrictions are imposed on water consumers in the city of Baltimore when restrictions are required by a water shortage, or (2) over or within limited areas when required because of water distribution system deficiencies. Before restrictions are imposed in any limited area in any of certain counties, the water engineer shall determine that the unrestricted use of water in all other areas of any of said counties will have no detrimental effect on the area to be restricted. The county commissioners of said counties have the power to pass any and all ordinances or regulations necessary for the imposition of such restrictions and to provide penalties for their violation. (Carruthers-Fla)
W69-08334

CREEKS OR RUNS; WIDENING, STRAIGHTENING, ETC.

Del Code Ann tit 9, sec 1526 (Supp 1966).

Descriptors: *Delaware, *Streams, *Alteration of flow, *Flow augmentation, Local governments, Legislation, Condemnation, Condemnation value, Land use, Public benefits, Riparian owners, Diversion, Surveys, Eminent domain, Administrative agencies, Stream improvement.
Identifiers: Land purchase, Public dedication.

When the County Council of New Castle County, upon the advice of the Department of Public Works, deems it advisable to widen or straighten any creek in the county, the Council and Department may enter the land for the purpose of surveying and locating necessary changes. Owners of land which must be taken to alter the creek may dedicate the land or the County Council may purchase it upon such terms as it deems advisable. If the owner and Council cannot agree on terms, the Council may acquire the land by condemnation. (Kahle-Fla)
W69-08337

CONSTRUCTION OF IMPROVEMENT.

SC Code Ann secs 18-271 thru 18-284 (1962).

Descriptors: *South Carolina, *Drainage, *Construction, *Administrative agencies, Drainage districts, Contracts, Construction costs, Bridges, Lands, Right-of-way, Land clearing, Lumber, Outlets, Condemnation, Condemnation value, Adjudication procedure, Ditches, Drains, Watercourses (Legal), Highways, Assessments, Laterals, Engineering structures, Drainage systems, Levees, Legislation, Railroads.
Identifiers: Notice, Improvements, Competitive bidding, Fences.

Whenever an improvement is to be made in a drainage system, the drainage commission must give two weeks notice before making such improvement. There shall be competitive bidding before such improvement is contracted. The contractor may enter any lands necessary for the construction and removal of any bridge, fence or timber that will hinder the work. A right-of-way through lands not affected by the drainage system may be obtained by condemnation. Whenever the drain crosses a highway, all costs of replacing said highway shall be paid by the county. If the highway is beneficially affected, the county shall be assessed for the improvement. The commission may obtain rights-of-way over railroad crossings but the work shall be done in such a manner as to cause the least interference with the operation o of the railroad. The owner of land who has been assessed for the construction of a drainage ditch has a right to use said ditch as an outlet for lateral drains from his land. The commission may join with the proper officials of the adjoining counties of any other state in the construction or improvement of any drainage system. (Shevin-Fla)
W69-08339

PROCEDURE TO ESTABLISH DISTRICTS.

SC Code Ann secs 18-211 thru 18-224 (1962).

Descriptors: *South Carolina, *Drainage districts, *Adjudication procedure, *Public benefits, Levees, Drains, Canals, Ditches, Watercourses (Legal), Construction, Land reclamation, Swamps, Wetlands, Overflow, Public health, Tile drainage, Costs, Right-of-way, Land tenure, Assessments, Administrative agencies, Surveys, Publications, Legislation, Highways.
Identifiers: Drainage improvements, Tide gates, Notice, Public highways, Counties, Engineer.

The clerk of the court of common pleas of any county may establish a drainage district in his county. A majority of the landowners in an area may file a petition requesting a drainage district and post bond. The clerk shall then serve a summons o landowners who have not joined in the peti The summons may be served by publication. clerk shall then appoint an engineer and tw sident freeholders to examine the land and file port on the practicability of the proposed di and any benefits which might inure from it. I report is unfavorable the petition shall dismissed. If the report is favorable the clerk set a day for a hearing. Notice of the hearing be published. At the hearing it shall be determ if each landowner in the proposed district benefit. Any landowner who will not benefit be withdrawn from the district. At the hea those present shall discuss the sufficiency of district and the need for any changes. If the cle satisfied by the proceedings, he may declare district established. Any person aggrieved by decision may appeal to the court of common p for the county. (Shevin-Fla)
W69-08340

EXCAVATING AND DREDGING IN PUB WATERS.

NH Rev Stat Ann secs 488-A:1 thru 488 (1968).

Descriptors: *New Hampshire, *Excavat *Dredging, *Permits, Legislation, Water le State governments, High water mark, Adminis tive agencies, Relative rights, Riparian rights, L aspects, Adjudication procedure, Regulat Public rights, Swamps, Marshes, Wetlands, L reclamation, Restoration, Land tenure.
Identifiers: *Public waters, *Water resou board, Natural ponds.

Any owner of a shore line on public waters des to dredge land below the natural mean high w level of the public water must obtain authorizat The water resources board handles all petitions this authorization. After proper notice and a pu hearing, the board recommends action to governor and council. The governor and cou may then grant the right for just consideration. laters are subject to a maximum $1,000 fine may be compelled to return the land to its orig condition. (Breeze-Fla)
W69-08342

TIDAL WATERS.

NH Rev Stat Ann secs 483:A-1 thru 483 (1968).

Descriptors: *New Hampshire, *Port authori *Dredging, *Excavation, *Tidal waters, Mars Shellfish, Wildlife conservation, Fisheries, Ru Administration, Administrative agencies, Bank bility, Swamps.
Identifiers: Violations, Fines.

Prior to any proposed excavating, filling dredging of any bank, flat, marsh or swamp in adjacent to tidal waters, written notice acc panied by a detailed plan of such proposal mus submitted to the New Hampshire Port Autho Said authority shall hold a public hearing on proposal after notifying the person intending t the work, the water supply and pollution co commission and the New Hampshire fish and g department of the time and place of said hea The port authority may deny the petition or req additional installations to prevent subsequen runoff back into tidal waters. If the proposed contains shellfish or other fisheries and wild conditions or measures may be imposed by authority to protect such resources. Any part the action or proceedings of the port authority apply for a rehearing. Violators of this chapter be liable for abatement of any structures place violation hereof and subject to a one thousand lar fine. (Holt-Fla)
W69-08343

MS AND FLOWAGE (ADMINISTRATION, OCEDURE, AND APPEALS OF NEW MPSHIRE WATER RESOURCES BOARD).

Rev Stat Ann secs 482:60 thru 482:73 (1968).

criptors: *New Hampshire, *Administration, cision making, Legislation, Adjudication edure, Costs, Investigations, Dams, Legal cts, Judicial decisions, Water resources lopment, Management, Administrative agen-Regulation.
tifiers: *Hearings, *Penalty, *Appeals.

inistration, procedure, and appeals of the New pshire Water Resources Board are provided. Board exercises a judicial function in making sions under regulations and rules of the Water ources Board. The qualifications, temporary pintments and compensation for board mem- are provided. The Water Resources Board is norized to expend funds granted it by the slature for performing its duties. A majority of Board shall constitute a quorum to transact ness. On certain occasions, investigations may eld by one or more members. The Board is em-ered to subpoena and examine dam owners and r records or any other person. Failure to appear ilure to observe the rules and regulations of the er Resources Board is a punishable offense. dd-Fla)
9-08345

ACING FILL IN PUBLIC WATERS.

Rev Stat Ann secs 482:41-e thru 482:41-i 68)

criptors: *New Hampshire, *Landfills, *Land ning, *Public rights, Administrative agencies, islation, Water law, Water policy, Legal cts, Jurisdiction, Permits, Regulation, Govern-nts, State governments, Local governments, eral government, Riparian rights, Flow, Flow trol, High water mark, Piers, Water levels.
tifiers: Public water, Penalties (Civil), Penal-(Criminal), Wharves.

person may fill below the mean high water level ny public waters, defined as all natural ponds eeding ten acres, with the effect of forming d land along the edges of such water bodies. lic owned water bodies, ie those whose artificial water level is maintained by the state's exer-of its flowage rights, are similarly restricted. n proper notification of the water resources rd, the federal, state, or municipal governments not restricted by this section and may fill ond the high water mark of such water bodies. board also reviews plans for construction of all mercial piers and wharves. Subject to a lengthy inistrative procedure which includes approval public hearing held by the water supply and ution commission, the fish and game commis-, the division of public health, the governor and ncil may grant a petition asking the right to fill lic waters. The water resources board acting ie may grant permission to fill below the artifi-ly created high water level of a publicly owned er body. Persons illegally placing fill are subject ine and may be compelled to remove same by superior court. (Johnson-Fla)
9-08346

QUISITION OF LAND BY UNITED STATES R FLOOD CONTROL AND NAVIGATION.

Rev Stat Ann secs 122:1 thru 122:8 (1964), as nded (Supp 1967).

criptors: *New Hampshire, *Reservoirs, vigation, *Flood control, State jurisdiction, eral government, Land use, Land management, rs, Legislation, Taxes, Water resources lopment, Condemnation, Jurisdiction.
tifiers: *Land acquisition, Federal constitu-, Connecticut River, Merrimack River.

Consent is given, in accordance with the federal constitution, to the acquisition by the United States by purchase or condemnation, of state lands for use in connection with: (a) Bethlehem Junction Reservoir on the Ammonoosuc River; (b) Surry Mountain Reservoir on the Ashuelot River; (c) Blackwater Reservoir on the Blackwater River; and (d) Franklin Falls Reservoir on the Pemigewasset River; authorized by Congress for the benefit of navigation and control of flood waters in the Connecticut and Merrimack rivers. The state shall retain concurrent jurisdiction for purposes of civil and criminal processes and jurisdiction shall revert to the state when such lands shall cease to be the property of the United States. Consent is also given to the acquisition of land for additional projects authorized by the governor and council upon recommendation of the water resources board. Provisions are made for payment by the state to cities and towns of sums representing taxes lost by federal acquisition of the land. (Kahle-Fla)
W69-08352

FLOWAGE.

NH Rev Stat Ann secs 482:16 thru 482:22 (1968).

Descriptors: *New Hampshire, *Dams, *Water policy, *Administrative agencies, Regulation, Legislation, Water law, Legal aspects, Dam construction, River regulation, Flood control, Flow, Flow control, Water levels, Riparian rights, Water conservation, Water management (Applied), Water utilization.

Upon obtaining authorization, a landowner or another with the owner's consent may erect and maintain a dam across any stream or may increase the height of any dam (by flashboards or permanent construction) for the purposes of working any mill on such stream, creating a reservoir of water or raising the level of a public lake, or conservation or equalization of the flow of such stream. The rights of others operating dams and a town's rights over highways and bridges may not be adversely affected thereby. An owner of a dam must petition the water resources board for a hearing before he is allowed to erect a dam or increase the height of an existing one. The board investigates such things as necessity of timber clearing, increased hazards to navigation, and effect on wildlife before issuing its order. This order shall incorporate all its findings. (Johnson-Fla)
W69-08354

DAMS AND FLOWAGE: PROCEEDINGS IN COURT.
NH Rev Stat Ann secs 482:23 thru 482:34 (1968).

Descriptors: *New Hampshire, *Dam failure, *Damages, *Judicial decisions, Administrative agencies, Legislation, Legal aspects, Water law, Water policy, Riparian rights, Dam construction, Dam design, Flow control, Flood control, Remedies, Damsites, Water control, River regulation, Water conservation, Land use, Water resources.

When land is overflowed, drained, or otherwise damaged by use of any dam, the person erecting or maintaining such dam is liable for the damage caused thereby. Settlement may be out of court or in the superior court of the county where such damage took place. Unless the parties agree to provisions of the petition which must state the location of the dam, extent of damages, and be filed with the court, a committee of three disinterested persons is appointed by the forum to determine the truthfulness of matters alleged in the petition. A jury trial as to the extent of damages may be had prior to reference of such petition to the committee. Any person wishing to build a new dam or increase permanently or by flashboards the size of an existing dam must petition the superior court for permission. Such person may be required to post security for damages which may arise from such action. The governor and council can approve the flooding of public lands contiguous to a damsite when the public interest is served thereby. (Johnson-Fla)
W69-08357

REGULATION OF WATER RESOURCES.
Del Code Ann Tit 7, Secs 6101-6105 (Supp 1966).

Descriptors: *Delaware, *Water resources, *Water management, *Delaware River Basin Commission, Water use, Surface waters, Ground water, Water supply, Watercourses (Legal), Administrative agencies, Ponds, Dams, Reservoirs, Lakes, Rivers, Agricultural watersheds, Domestic Water, Legislation, Legal aspects, Water law, Compacts, Administrative regulations, Planning, Water resources development, Delaware river, Equitable apportionment.

Water resources are to be regulated to assure their optimum beneficial use. Definitions of 'domestic and agricultural use', 'established average minimum flow', 'municipal use', 'surface water', 'underground water', 'water facilities', and 'watercourse' are defined for purposes of this statute. The provisions of this chapter shall not apply to (1) water use for domestic and agricultural purposes unless contributing to a water emergency; (2) a landowner's right to dam a stream originating on his property; (3) the right to build a dam or pond and divert water on any stream with a certain minimum daily flow; (4) ponds not larger than 60,000 square feet used for conservation and/or recreation. The commission shall: (1) adopt master water plans for development and use of water resources; (2) advise the Delaware River Basin Commission; (3) study and investigate matters connected with water use; (4) approve the use of water on the basis of equitable apportionment; (5) approve new plans for water facilities; (6) require reports from all Delaware water users regarding water facilities and water use and; (7) adopt reasonable rules and regulations which conform to those of the Delaware River Basin Compact, where applicable. After July 1, 1966 approval of the Commission is needed for any increase in the amount of water used. (Carruthers-Fla)
W69-08360

DAMS IN DISREPAIR AND CHANNEL IMPROVEMENT.
NH Rev Stat Ann secs 482:35-482:41 (1968).

Descriptors: *New Hampshire, *Administrative agencies, *Water policy, *Dams, Water law, Legislation, Legal aspects, Political aspects, Dam construction, River regulation, Flood control, Local governments, Regulation, Flow, Flow control, Water levels, Financing, Contracts, Leases, Procurement, Water conservation, Water management (Applied), Water resources, Water utilization, Condemnation, Dam construction.
Identifiers: Dam repair, Bonds, Notes.

It is state public policy to repair and construct dams, clear streams, and improve channels for the regulation of water levels, water flow, lessening of flood damage, fire prevention and control and other matters related to conservation and control of state water resources. To carry out these policies the water resources board may acquire, lease, and condemn such property as is necessary to repair or construct dams and it may enter into agreements with private individuals and corporations in furtherance of such policy. The council on resources and development constitutes an advisory board which consults with the water resources board when the latter plans initiation of facilities under this chapter. Upon approval by the resources board, proposals are submitted to the governor and council who must approve such facilities before actual work may be undertaken upon them. Municipalities may finance their share of such facilities by issuance of serial notes or bonds as they may be required in an agreement reached between the state and the local government. (Johnson-Fla)
W69-08361

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INTERFERENCE WITH NAVIGATION, ETC.

SC Code Ann secs 54-401 through 54-405 (1962).

Descriptors: *South Carolina, *Federal government, *Navigation, *Buoys, Ships, Boats, Boating regulations, Regulation, Navigable waters, Legislation, State governments, Damages, Structures, Lighthouses, Anchors, Repairing.
Identifiers: *Navigation aids, Penalties, Liens.

Mooring to, removing, damaging, or accidentally injuring without giving notice to the lighthouse engineer, any buoy, beacon or daymark placed in state waters by the United States lighthouse board is punishable by fine or imprisonment. It is unlawful to anchor on the range-line of any range of lights unless such anchorage is unavoidable. The master of any vessel so anchoring shall be punished by fine not to exceed $50. Failure to keep clear of a marker, or unavoidably fouling it without exercising due diligence in clearing it to prevent dragging the marker from its position is punishable by fine not to exceed $50. The cost of repairing any marker shall be a lien against the vessel causing damage thereto. Any person willfully damaging, or counseling another to so damage, any structure used under the federal 'Act to Provide for Surveying the Coast of the United States' shall be punished by imprisonment not less than one month and/or fine not exceeding $50 and shall be liable for expenses of repairing the structure. (Kahle-Fla)
W69-08372

A PRECLASSIC WATER DISTRIBUTION SYSTEM IN AMALUCAN, MEXICO,
Wisconsin Univ., Milwaukee.
For primary bibliographic entry see Field 07B.
W69-08396

FOREST SITE AMELIORATION IN THE COASTAL FLATWOODS OF MISSISSIPPI,
Mississippi State Univ., State College. School of Forest Resources.
W. Frank Miller.
Completion Report, Mississippi Water Resources Research Institute, July, 1969. 17 p, 4 tab, 9 fig, 18 ref. OWRR Project A-013-MISS.

Descriptors: *Drainage, Forest soils, *Growth response, Drainage effects, *Forest management.

Increasing interest is being evidenced in the management of wetland forest sites in both the Atlantic and Gulf Coastal Plains. It is estimated that there exists over 20 million acres of these wetland sites which are not achieving their maximum potential for wood production. The results of this investigation indicate that for the particular physical soil situation examined, drainage of these lands will appreciably increase growth rates. The major effect of ditching was to provide for a more rapid removal of surface water which would normally be ponded for extensive periods. Growth response of slash pine at the end of the second growing season indicated that although there was no statistical difference between seedlings on plots with 2 1/2 chain or 5 chain lateral ditch spacing, seedling growth was significantly better on drained areas when compared with undrained areas. Loblolly pine did not respond to treatment. Growth projections for slash pine based on seedling growth, stem analysis of an older plantation, and extrapolated site index curves indicated that the drainage treatments are economically feasible. A randomized complete block study of the effects of drainage and fertilization on sweetgum and sycamore was initiated in January, 1968. At the end of the first growing season, heights of sycamore seedlings in all treatments were greater than sweetgum heights in the same treatments. Heights of sycamore seedlings in the fertilized and drained treatment were statistically superior to those seedlings in the fertilized and undrained treatment.
W69-08397

A NONDIMENSIONAL APPROACH TO THE FLOW OF WATER IN FLUMES AND CANALS,
Mississippi State Univ., State College. Dept. of Agricultural and Biological Engineering.
For primary bibliographic entry see Field 08B.
W69-08398

FOREST DRAINAGE RESEARCH IN THE COASTAL PLAIN,
Forest Service (USDA), Charleston, S. C. Southeastern Forest Experiment Station.
Ralph A. Klawitter, and Cortland E. Young, Jr.
J. Irr. and Drain. Div., ASCE, 91 (IR3):1-7, Sept. 1965.

Descriptors: *Drainage, *Reclamation, *Coniferous forests, *Wetlands, Water injury, Ditches, Drainage practices, Gulf coastal plain, Plant growth, Pine trees.

This paper represents preliminary information on expected increases in wetland soil productivity as a result of drainage. Results are based on a study in northwest Florida and a survey in coastal North Carolina. Soil productivity increases were assessed in terms of pine tree height and volume growth.
W69-08437

DRAINAGE,
Forest Service (USDA), Charleston, S. C. Southeastern Forest Experiment Station.
Ralph A. Klawitter.
Proc. Symposium on hardwoods of the Piedmont and Coastal Plain, Ga Forest Res Council, p 16-17, Oct 1966.

Descriptors: *Drainage, *Reclamation, *Wetlands, *Ditches, Drainage effects, Land management, Plant growth, Deciduous trees, Watershed management, Flood plains.

Site changes resulting from drainage of swamps and bottomlands will change stand composition, growth, and regenerative potential. Hundreds of miles of canals have already been dug to handle flow. One can only speculate about the effects on hardwood growth, fish and wildlife habitats, streamflow and soil-water levels.
W69-08438

STREAMFLOW - AN IMPORTANT FACTOR IN FOREST MANAGEMENT IN THE COASTAL PLAIN,
Forest Service (USDA), Charleston, S. C. Southeastern Forest Experiment Station.
For primary bibliographic entry see Field 02E.
W69-08439

HYDROLOGY OF WETLAND FOREST WATERSHEDS,
Forest Service (USDA), Charleston, S. C. Southeastern Forest Experiment Station.
Cortland E. Young, Jr., and Ralph A. Klawitter.
Conference Proceedings - Hydrology in water resources management, WRRI Report No 4, Clemson Univ, S C, p 29-38, 1968.

Descriptors: *Hydrologic cycle, *Wetlands, *Storm runoff, *Evapotranspiration, Forests, Water balance, Runoff, South Carolina, Atlantic Coastal Plain, Watersheds (Basins), Water control, *Water management (Applied), Precipitation (Atmospheric).

The resource potential of coastal plain wetland forests can be greatly increased by scientific water management; however, this cannot be accomplished without a basic knowledge of the hydrology of these areas. Preliminary results from a 400-acre wetland watershed on the Santee Experimental Forest show that average annual storm runoff was approximately twice that from forested watersheds in the Piedmont and mountains; furthermore, during wet periods peak runoff rates were double those computed for the watershed by an accepted drainage formula. Measured evapotranspir was slightly greater than Thornthwaite's pote ET.
W69-08440

SOILS INFORMATION USED AND NEE FOR WOODLAND PRODUCTION: RESEA FINDINGS - ORGANIC SOILS,
Forest Service (USDA), Charleston, S. Southeastern Forest Experiment Station.
Ralph A. Klawitter.
Proc South Soil Survey Work Planning C USDA, S C S, Clemson Univ, 7 pp, Jul 1968.

Descriptors: *Drainage, *Reclamation, *Wetl *Soils, *Organic soils, Drainage effects, T Coniferous forests, Land management, Water management, Soil management, Soil investigat

The woodland owner needs to know the bota origin and stratigraphy of the peat, as well a thickness, degree of decomposition, wood con acidity, water sources and hydraulic conduct The kind of subsoil material, amount of mi and soil mixed into the peat, and natural fer and vegetation are all information that will be to use in selecting peatlands for woodland drai and planting. Such detailed knowledge will be not only in timber production, but in wil habitat improvement, in forage productio water management and by engineers in road other construction as well.
W69-08441

WIND DAMAGES IMPROPERLY PLAN SLASH PINE,
Forest Service (USDA), Charleston, S. Southeastern Forest Experiment Station.
Ralph A. Klawitter.
South Lumberman, Mar 1, 1969. p 26.

Descriptors: *Drainage, *Reclamation, * trees, *Winds, *Planting management, F management, Soils, Land management, growth, Trees, Gulf coastal plain, Water management.

Planting techniques can affect the growth development of tree seedlings as well as susceptibility to wind damage. The paper desc how slash pine seedlings developed a notic lean on a drained area in northwest Florida details the reasons: wind, wet soil and poor pla practice.
W69-08442

WATER TABLE, SOIL MOISTURE, AND YGEN DIFFUSION RELATIONSHIPS ON DRAINED WETLAND FOREST SITES,
Forest Service (USDA), Charleston, S Southeastern Forest Experiment Station.
Cortland E. Young, Jr.
Soil Science, 107 (3):220-222, Mar 1969. 3 fig, 10 refs.

Descriptors: *Water table, *Soil moisture, * tion, *Statistical models, *Forest soils, Wetl Forests, Atlantic Coastal Plain, Root zone, R sion analysis, Drainage, Water management plied).
Identifiers: *Oxygen diffusion rate, Plummer Bayboro clay loam, Small plots.

Statistical models have been developed to e the relationship between (1) depth to water and soil moisture content at 6- to 18-inches (2) depth to water table and oxygen diffusio at 12 inches. Measurements of the above pa ters were made on two 1/10-acre plots at biw intervals over a 2-year period. The soil types pled included Bayboro clay loam and Plu loamy sand. Regression techniques were utili construction of the models. Results indicate for the soils studied: (1) soil moisture conte negatively related to depth to the water table complex equation was required to express th

ships, and (2) oxygen diffusion rate was posi-
ly and linearly related to depth to the water ta-
Some of these models agreed with data
lished in the literature whereas others did not.
coefficients of determination were reasonably
for all the relationships.
9-08443

IMER DEFERRED GRAZING CAN IM-
OVE DETERIORATED SEMIDESERT
NGES,
est Service (USDA), Albuquerque, N. Mex.
ky Mountain Forest and Range Experiment
ion.
F. Aldon, and George Garcia.
Forest Serv Res Note RM-95. 3 p.

criptors: *Ranges, Carrying capacity, Land
agement, *Forages, Vegetation establishment,
luctivity, *Flood plains, *Erosion control.
tifiers: Range science, Forage production.

earch in west-central New Mexico showed al-
sacation on flood plains offers management its
chance for increasing productivity of
idesert lands. It is highly palatable, and can
luce much herbage on a relatively small area.
ler summer deferred grazing, production of al-
sacaton has been gradually increasing in spite
ariable precipitation.
9-08462

FERRED GRAZING AND SOIL RIPPING IM-
OVES FORAGE ON NEW MEXICO'S RIO
ERCO DRAINAGE,
est Service (USDA), Albuquerque, N. Mex.
ky Mountain Forest and Range Experiment
ion.
F. Aldon.
lex Stockman 31 (11): 44, 46.

criptors: *Erosion control, Soil surfaces, Soil
cture, *Ranges, Soil stability, *Overland flow,
rages.
ntifiers: Range science, Forage production,
und cover.

mmer-deferred grazing significantly increased
ground-cover index and reduced sediment
ds on the Rio Puerco drainage. Soil ripping also
eased forage production. Largest gains in plant
er occurred on alluvial flood plains growing al-
sacation.
9-08463

APPLICATION OF LINEAR PRO-
AMMING TO EFFICIENCY IN OPERATION
A SYSTEM OF DAMS,
theon Co., Waltham, Mass.
rray Mannos.
onometrica, Vol 33, No 3, p 335-336, July 1955.

criptors: *Linear programming, *Reservoir
ration, *Power operation and maintenance,
imization, *Multiple purpose reservoirs,
riability, Reservoir storage, Approximation
hod, Dams, Missouri River, Hydroelectric
er.

ear programming techniques were used to
rmine the optimal operation of a system of six
tipurpose dams on the Missouri River. Power
eration was one of the considerations. The ob-
ive of the research was to determine variations
he reservoir storages, so as to maximize the
rgy obtained from the entire system. Physical
tations on the storages and releases appeared in
form of inequality constraints. An approxima-
to a change in energy was given as a linear
tion of the storage variations. (Thiuri-Cornell)
9-08536

NKING UP SOME CRACKS,
eral Water Pollution Control Administration,
hington, D. C. Div. of Technical Control.
primary bibliographic entry see Field 06A.
W69-08539

RANDOM WALK AND RANDOM ROUGHNESS MODELS OF DRAINAGE NETWORKS,
Technion - Israel Inst. of Tech., Haifa. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02E.
W69-08571

TWO-DIMENSIONAL SEEPAGE OF BONDED WATER TO FULL DITCH DRAINS,
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 02F.
W69-08576

FLOOD PLAIN INFORMATION NEUSE AND TRENT RIVERS AND JACK SMITH CREEK, NEW BERN, NORTH CAROLINA.
Corps of Engineers, Wilmington, N. C.

Corps Eng Flood Plain Rep, May 1969. 42 p, 10 fig, 11 plate, 4 tab. Prepared for the city of New Bern.

Descriptors: *Floods, *Flood damage, *North Carolina, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: New Bern (N C), Standard project flood, Intermediate regional flood.

Flooding of the Neuse and Trent Rivers, New Bern, North Carolina is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these appraoches. (Knapp-USGS)
W69-08593

FLOOD PLAIN INFORMATION, TIDAL LANDS OF CAPE MAY COUNTY, NEW JERSEY.
Corps of Engineers, Philadelphia, Pa.

Corps of Eng Flood Plain Rep, June 1968. 70 p, 14 fig, 11 plate, 11 tab.

Descriptors: *Floods, *Flood damage, *New Jersey, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Cape May County (NJ), Standard project flood, Intermediate regional flood.

Flooding of Cape May Co., New Jersey is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-08609

FLOOD PLAIN INFORMATION, UPHAM BROOK, HENRICO, VIRGINIA.
Corps of Engineers, Norfolk, Va.

Corps Eng Flood Plain Rep, May 1968. Main Rep, 14 p, 6 fig, 7 photo. Tech append, Text, 7 plate, 4 tab, 2 exhibits.

Descriptors: *Floods, *Flood damage, *Virginia, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Henrico County (Va), Upham Brook, Standard project flood, Intermediate regional flood.

Flooding of Upham Brook, Henrico County, Virginia is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-08610

4B. Groundwater Management

CALIFORNIA'S DIGITAL COMPUTER APPROACH TO GROUNDWATER BASIN MANAGEMENT STUDIES,
California State Dept. of Water Resources.
Ernest M. Weber, Helen J. Peters, and Michael L. Frankel.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Int Ass Sci Hydrol, Pub No 80, Vol 1, pp 215-223, 1968. 9 p, 4 fig.

Descriptors: *Mathematical models, *Groundwater basins, *Water management (Applied), *Systems analysis, *California, Simulation analysis, Optimization, Data processing, Digital computers, Economics, Aquifers, Water yield, Hydrologic budget, Water storage, Surface waters, Groundwater.
Identifiers: Groundwater basin management (Calif).

The California Department of Water Resources has been developing since 1959 a computerized approach to the planning studies of integrated management of groundwater and surface water supplies, storage and transmission. Formulation and economic comparison of a wide range of alternative plans required development of computer models of the groundwater basin and the surface water delivery system, and computer programs for developing cost of each alternative plan of integrated operation under study. A 2-space dimensional-diffusion mathematical model of the groundwater basin has been developed which incorporates the nonlinear features of transmissibility variation with saturated thickness, rising and repercolating waters, and transmissibility variation at depth. Selection of the digital approach is related to data availability and the sensitivity of the economic analysis to the scale of the physical model. Digital model validation is speeded by on-line hydrograph plots. The diffusion model is also used for analysis of the surface delivery system. The economic analyses are restricted to physically feasible plans. Variable costs for each plan are developed. (Knapp-USGS)
W69-08235

GROUND WATER RESOURCES IN THE KOCHI PLAIN, SOUTHWEST JAPAN (JAPANESE),
Industrial Science and Technology Agency, Kawasaki (Japan). Geological Survey.
For primary bibliographic entry see Field 02F.
W69-08248

GEOLOGY AND GROUNDWATER OCCURRENCE IN SOUTHEASTERN McKINLEY COUNTY, NEW MEXICO,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02F.
W69-08287

GROUNDWATER RESOURCES OF UPTON COUNTY, TEXAS,
Geological Survey, Washington, D. C.

LIBRARY OF U. SOUTH DAKOTA

For primary bibliographic entry see Field 02F.
W69-08288

THE CONTROL OF GROUNDWATER OCCURRENCE BY LITHOFACIES IN THE GUADALUPIAN REEF COMPLEX NEAR CARLSBAD, NEW MEXICO,
Massachusetts Univ., Amherst.
Ward S. Motts.
Bul, Geol Soc Amer, Vol 79, No 3, pp 283-298, March 1968. 16 p, 8 fig, 4 pls, 18 ref.

Descriptors: *Groundwater movement, *New Mexico, Groundwater barriers, Aquifer characteristics, Deep percolation, Base flow, Flow characteristics, Geomorphology, Obstruction to flow, Subsurface flow, Underground streams, Carbonate rocks, Caves, Geohydrologic units, Geologic control, Geologic formations.
Identifiers: *Lithofacies, Pecos River, Guadalupian Reef Complex.

It was determined that occurrence and movement of water in the Guadalupian Reef complex of southeastern New Mexico is controlled primarily by lithofacies. The following major Guadalupian lithofacies are described and related to regional hydrology: (1) a basin facies of very low permeability which confines groundwater, (2) a reef-zone facies of very high permeability, (3) a shelf-carbonate facies ranging from very high permeability near the reef-zone to low permeability near the shelf-evaporite facies and (4) a shelf-evaporite facies of moderate permeability. Permeability is greatest in coarser-grained rather than fine-grained detrital carbonates and in calcareous rather than dolomitic rocks. The presence of potable water west of the Pecos River and the highly mineralized water east of the Pecos in rocks of similar stratigraphic position indicates that the Guadalupe and Sacramento fault blocks were uplifted and trenched by the Pecos River. Highly mineralized water from the west drained into the river and fresh meteoric water could then circulate toward the Pecos River discharge area, causing extensive solution of the limestone rocks. (Sherbrooke-Ariz)
W69-08294

GROUNDWATER POTENTIAL OF KARST AQUIFERS IN SAUDI ARABIA,
Ministry of Agriculture and Water, Riyadh (Saudi Arabia); and Food and Agriculture Organization of the United Nations, Rome (Italy).
For primary bibliographic entry see Field 02F.
W69-08296

GROUND WATER OF THE WESTERN DESERT IN IRAQ,
Baghdad Univ. (Iraq). Dept. of Geology.
For primary bibliographic entry see Field 03C.
W69-08298

WATER RESOURCES INVESTIGATION IN A SEMIARID BASIN IN ARIZONA, U.S.A.,
Geological Survey, Tucson, Ariz. Water Resources Div.
For primary bibliographic entry see Field 02F.
W69-08299

SURFACE-WATER INFILTRATION AND GROUNDWATER MOVEMENT IN ARID ZONES OF VENEZUELA,
Instituto Venesolano de Investigaciones Cientificas, Caracas.
M. A. Tamers.
Symposium on Isotopes in Hydrology, Vienna, 1966, Proceedings pp 339-353, 1967. 15 p, 5 fig, 1 tab, 20 ref.

Descriptors: *Aquifer characteristics, *Radiocarbon, Arid lands, Evaporation, Aquifers, Artificial recharge, Carbonate rocks, Radioactive dating, Bicarbonates, Carbonates, Deepwells, Faults (Geology), Groundwater movement, Groundwater recharge, Overdraft, Natural recharge, Arid climates, Age, Infiltration, Surface runoff, Rainfall, Permeability, Transpiration.
Identifiers: *Venezuela.

Radiocarbon dating of the carbonate species present in groundwater was utilized to obtain information on the recharge of underground deposits as well as directions and rates of movement. Dissolved carbonates are of two types: modern carbon is from the atmosphere (CO sub 2) and products of plants in the soil, while ancient carbon comes from dissolving limestones. The later is essentially free of radiocarbon, causing falsely old dates for the total groundwater carbonates. Adjustments of the dates were made for the limestone contribution employing bicarbonate and total carbon concentrations. Aquifers of Barquisimeto, Maracaibo, Coro, Paraguana and Valencia in Venezuela were investigated. Ages ranged from modern to 35,000 yr. The predominance of oldwater correlates well with the arid climatic conditions. Some 'modern' artificial recharge occurred from irrigation waters. Infiltration from rivers and lakes was studied. The rapid depletion of these aquifers and their importance to the Venezuelan economy is discussed. (Sherbrooke-Ariz)
W69-08306

AN ENGINEERING-ECONOMIC ANALYSIS OF SYSTEMS UTILIZING AQUIFER STORAGE FOR THE IRRIGATION OF PARKS AND GOLF COURSES WITH RECLAIMED WASTEWATER,
Nevada Univ, Reno. Dept. of Civil Engineering; and Nevada Univ., Reno. Center for Water Resources Research.
For primary bibliographic entry see Field 05D.
W69-08625

4C. Effects on Water of Man's Non-Water Activities

BRASWELL V STATE HIGHWAY AND PUBLIC WORKS COMM'N (WATER DAMAGE FROM DIVERSION).
108 SE2d 912-917 (NC 1959).

Descriptors: *North Carolina, *Water injury, *Road construction, *Diversion, Diversion structures damages, Judicial decisions, Legal aspects, Administrative agencies, State governments, Eminent domain, Easements, Property values, Flooding, Flood damage, Natural flow, Stream flow, Obstruction to flow.

Plaintiff's land and home were located in a subdivision adjacent to a highway still under construction. During the highway construction, defendants diverted a stream which on several occasions caused flood damage to plaintiff's home and property. Defendants admitted the diversion but contended that liability could be imposed on a governmental agency only for damages resultant from negligence in the road construction. Plaintiffs based their claim on the general rule that liability exists for damage resulting from a diversion of water and on the rule that the right to have water flow in the direction provided by nature is a property right which must be compensated for when destroyed. The court held for plaintiffs on their contentions above and noted that negligence need not be alleged to create liability for a diversion. (Carruthers-Fla)
W69-08311

HACKENSACK WATER COMPANY V VILLAGE OF NYACK (ACTION TO RECOVER FOR WITHDRAWAL LOSS).
289 F Supp 671-686 (SDNY 1968).

Descriptors: *New York, *Utilities, *Withdrawal, *Diversion losses, Prescriptive rights, Judicial decisions, Local governments, Cities, Reasonable use, Riparian rights, New Jersey, Diversion, Stream flow, Compensation, Consumptive use, flow, Alteration of flow, Damages, Re Water Works, Relative rights, Approp Water users, Legislation.

Plaintiff water service company owns riparia in New Jersey along a river. The land is locat miles from the point where the defendant's works obtain water from the river. Plaintiff a that defendant's diversion rendered the fl adequate to meet plaintiff's water supply r ments. Plaintiff sought compensation f withdrawal and diversion. Under both New and New York law, the upstream riparian may not unreasonably divert or appropriate of a flowing stream. The question of wha stitutes reasonable use by a riparian owner is fact, thus, a summary judgment cannot be Since New York statute required the gi notice within ninety days after the cla damages arose, the plaintiff was barred recovering damages incurred more than days prior to the service of notice. The grant New York Water Resources Commission right to divert water without making compe to the lower riparian owner would constitute ing of property without compensation. (Chil W69-08312

LAYING OUT, ALTERING AND DISCON ING HIGHWAYS.
Me Rev Stat Ann, Tit 23, Secs 652, 705 (651 (Supp 1968).

Descriptors: *Maine, *Highways, *Ditches, verts, Legislative, Administrative ag Damages, Drains, Easements, State govern Highway relocation, Civil engineering, Roa struction, Roads, Drainage, Assessments, struction, Flow, Remedies, Legal aspects.

The state highway commission may co ditches and drains to carry water away fr highway under its supervision, and over or t any lands when it deems it necessary. No suc or drain shall pass within 20 feet of any d without the owner's consent. Wherever, highway, ditches or drains have existed for years, there shall be a conclusive presumpti easements for flowage from such ditches or exist, but only to the extent of the original fl If the change in grade of any state or st highway injures an adjoining landowner, apply to the commission within 6 month determination and assessment of his damag if they are unable to settle the damages, the Land Damage Board. An adjoining landowr also petition the commission to have a cul stalled to provide an entrance to his propert culvert shall be maintained by the comm (Heckerling-Fla)
W69-08314

CAMPBELL V STATE HIGHWAY CO SIONER (COMPENSATION FOR COND TION OF A SPRING AND AN EASEMEN
165 SE2d 281-285 (Va 1969).

Descriptors: *Virginia, *Springs, *Water *Easements, *Condemnation, Judicial de Legal aspects, Water contracts, Water Pipelines, Water rates, Confined water, Reservoirs, Right-of-way, Cities, Damage construction, Pumps, Water delivery, Co tion, Land tenure, Condemnation value.

Plaintiffs brought suit against the defend recover compensation for a spring taken i demnation proceeding. The spring was on adjacent to the plaintiffs and the plaintiffs tained an easement to the spring and f pipes across the adjacent property. The where the spring was located was conde the defendant. The defendants claimed water supply appropriated by the defend replaced by water purchased from a nea The court held the plaintiffs were ent

amages without any offset for the value of the city ater supply. The court stated that the conveyance the plaintiffs of the spring was a valid conyance of a property right. Defendants further ntended that plaintiffs had agreed to what mounted to a waiver of damages with the city ater as consideration. The court held that defennts had not proved this point. The court felt that e plaintiffs were entitled to just compensation for e value of the spring and easements that were ken and remaned the case for a determination of ese damages. (Shevin-Fla)
69-08321

TATE HIGHWAY DEPARTMENT, COST HARING IN HIGHWAY PROJECTS.
C Code Ann secs 33-167, 33-170, 33-171 (1962).

escriptors: *South Carolina, *Dams, *Water conol, *Road construction, *Cost sharing, Transportion, Highways, Flood control, Drainage systems, utters, Flow control, Administrative agencies, egislation, Routing, Water, Water conveyance, onduits, Levees, Costs, Cost allocation, Project lanning, Legal aspects, Roads, Bridges, Local overnments.
lentifiers: Water-controlling devices.

Vhen the cost of construction or repair of any ighway would be reduced by 1/3 with the conruction of a water-controlling device in connecon therewith, the State Highway Department may uthorize the construction of such device along ith the bridge and approach thereto and may hare the cost with any local government affected ereby. The Department may expend 2/3 of the mount necessary to cross any waterway without a ater-controlling device. The remainder shall be orne by the local government. The construction, uthorized by section 33-112 may include provions for sidewalks, parking, gutters, storm sewers, nd other such devices essential for highway serice and maintenance and to preserve and protect he highway investment. Municipalities may, with Department approval, maintain such city utilities ithin the highway right-of-way as are in accord ith sound engineering practices. All concomitant xpenses thereto shall be borne by the municipaliy. (Helwig-Fla)
V69-08338 .

LOATING TIMBER AND DAMAGE HEREFROM.

H Rev Stat Ann secs 489:1 thru 489:12 (1968).

escriptors: *New Hampshire, *Lumbering, Transportation, *Riparian rights, Legislation, egal aspects, Land tenure, Right-of-way, Banks, emedies, Damages, Rivers, Streams.
entifiers: Larceny of logs, Penalties (Civil).

he owner of improved land on which floating nber has lodged may detain the timber. He must st notice of any such timber detained. He may en hold the timber until the timber owner either ys damages and removal costs or gives a bond at ast twice the value of the property detained. If the rties cannot agree on the damages, either one ay request the selectmen for an assessment. ther party may appeal this assessment. The nber owner has five months from the posting of e notice to pay the damages, or give a bond, and move the timber. Otherwise the landowner may nvert the timber to his own use and recover mages in an action against the timber owner. The ner of unimproved land may detain lodged ber until the damages are paid. Anyone removthe lodged timber without payment of damages liable to the landowner. Interference with the w of logs, destruction of their markings, or fraulent conversion of timber floating and on the nks all constitute criminal offenses. (Breeze-Fla)
59-08341

GOLDIN V TRUSTEES OF VILLAGE OF ELLENVILLE (INTERFERENCE WITH WATER SUPPLY BY CITY).

296 NYS2d 1017-1019 (NY App Div 1969).

Descriptors: *New York, *Pipelines, *Water supply, Judicial decisions, Legal aspects, Local governments, Relative rights, Proprietary power, Pipes, Cities.
Identifiers: *Deeds, *Covenants, Injunction, Warranty deeds.

A village laid a pipeline through a farm by right of a warranty deed. The deed required the village to place a tap on the line near the specified tenant house to allow the landowners to draw free water. The water was for the use of the tenant family and livestock in a particular barnyard. The successors in title to a portion of the land sued to compel the village to furnish them with free water. The court affirmed a judgment to dismiss the complaint. The court held that the successors' claim must fail in absence of evidence that the particular tenant house and barnyard stipulated in the deed were once located on the successors' land. (Breeze-Fla)
W69-08355

ROAD CONSTRUCTION.

SC Code Ann sec 33-851 (1962).

Descriptors: *South Carolina, *Highways, *Road construction, *Ditches, Transportation, Flooding, Streams, Surface water, Surface runoff, Roads, Roadbanks, Embankments, Civil engineering, Grading, Slopes, Design, Road design, Washouts, Culverts, Construction, Legislation, Legal aspects, Local governments, Root development, Root systems, Flow, Streamflow.
Identifiers: Mileposts.

The roadbed of a road constructed in this state shall not be more than 16 feet wide exclusive of ditches and other obstructions. Roads through lands where water stands or flows must be ditched and the road bed raised. (Helwig-Fla)
W69-08365

STATE EX REL TETER V STATE ROAD COMMISSION (DAMAGE ASCERTAINMENT).

166 SE2d 757-761 (W Va 1969).

Descriptors: *West Virginia, *Condemnation, *Surface waters, *Condemnation value, Flood damage, Damages, Highways, Road construction, Eminent domain, Flooding, Land use, Land tenure, Compensation, Judicial decisions, Legal aspects, Drainage, Surface runoff.
Identifiers: Proceeding in mandamus.

Petitioners, as joint owners of property allegedly damaged by the construction of a new highway adjacent thereto, brought a proceeding in mandamus to compel the State Road Commissioner to institute condemnation proceedings against them to ascertain the amount of damage. Petitioners' property drained in a westerly direction across the site of the highway. Construction allegedly raised the elevation of this area and blocked this natural drainage. This caused surface water to flood their properties, damaging the land and buildings situated thereon. Evidence as to the extent of the damage was conflicting. The court held that where highway construction allegedly causes surface waters to flood property, an opportunity for judicial determination of any bona fide damage claim should be afforded the owners. The mandamus writ was granted. (Carruthers-Fla)
W69-08375

4D. Watershed Protection

KEEP MAINE SCENIC; ALLAGASH RIVER AUTHORITY.
For primary bibliographic entry see Field 06E.
W69-08131

SAMPLING AND ANALYSIS OF COARSE RIVERBED SEDIMENTS,
Agricultural Research Service, Oxford, Miss. Sedimentation Lab.
For primary bibliographic entry see Field 02J.
W69-08223

SHORE EROSION CONTROL DISTRICTS.

Md Ann Code Art 25, secs 167A-167E (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Erosion control, *Local governments, *Bodies of water, Estimated costs, Feasibility studies, Erosion, Legislation, State jurisdiction, Artificial watercourses, Lakes, Rivers, Streams, Construction costs, Shores, Shore protection, Administrative agencies.
Identifiers: *Erosion control districts.

The property in any county or Baltimore City abutting on any artificial or natural body of water in the state, whether tidal or nontidal, may be formed into a shore erosion control district. The owners of 75% of any property or 75% of the owners of any property may petition the county commissioners requesting the formation of a district. The petition shall describe the boundaries of the proposed district. The commissioners shall refer the petition to the shore erosion control section of the Department of Tidewater Fisheries which shall review the petition and report to the commissioners on the feasibility and need for a district. The report shall include the area to be included, plans for erosion control, and estimated costs. The commissioners are authorized to finance erosion control projects in the manner set out elsewhere in this article. (Kahle-Fla)
W69-08333

SOIL CONSERVATION DISTRICTS.

Md Ann Code Art 66C sec 89 (1957).

Descriptors: *Maryland, *Soil conservation, *Land management, *Political aspects, Drainage, Land, Land development, Legislation, Wildlife management, Mass wasting, Terracing, Erosion, Soil stabilization, Surface runoff, Ponds, Dikes, Flood control, Irrigation systems, Water resources, Area redevelopment, Local governments, Erosion control, Check structures.

Since agricultural lands are among the basic assets of the state, the state's policy is to preserve such lands in order to protect the health, safety, and general welfare of its people. Improper land practices have caused serious wind and water erosion of farm and grazing lands. This results in the loss of much topsoil. Failure of one owner to conserve the soil of his lands makes conservation of soil on other lands impossible. The consequences of such misuse include silting and sedimentation in stream channels, reservoirs, and dams, deterioration of soil productivity, destruction of cover and food for wildlife, and a diminishing of the underground water reserve. The correction of such problems by promotion of such appropriate soil conservation and land use practices as use of terraces, checkdams, dikes, ponds, strip cropping, land irrigation, rotation of crops and soil stabilization with trees or grasses is the policy of this state. (Johnson-Fla)
W69-08336

SOIL CONSERVATION AND IMPROVEMENT.
SC Code Ann, secs 63-211, 63-294, 63-302, 63-325 thru 63-327 (1962).

Descriptors: *South Carolina, *Administrative agencies, *Soil conservation, *Beach erosion, Local governments, Federal government, Flood control, Conservation, Drainage, Drainage districts, Land, Land development, Legislation, Legal

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aspects, Water policy, Erosion control, Land management, Soil management, Beaches, Governments, Encroachment.

Preservation and prevention of erosion on beaches in Charleston County being the responsibility of the county governing body, it must cooperate with all agencies of the United States Government to this end. However, it may deal with the federal government only when there is no state agency qualified to deal with problems of erosion and beach preservation. The Pawleys island erosion commission, composed of residents, of Georgetown County, is charged with making a study of the problem of beach erosion in the district and ways of retarding or preventing such erosion. It has power to construct and maintain such groins or other structures as are necessary to protect such beaches from encroachment by the ocean. The Greenvill County soil conservation district may acquire by condemnation such rights of way as are necessary for any authorized function of the district including acquisition of land for flood water retarding structures and flood plain boundaries. The Harry County Beach Preservation Association is charged with prevention and control of beach erosion within its district and enjoys official agency status which authorizes dealing with federal agencies. (Johnson-Fla)
W69-08370

SURFACE RUNOFF AND EROSION IN THE LOWER CHAPARRAL ZONE, ARIZONA,
Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
Lowell R. Rich.
Forest Service USDA, Rocky Mountain Forest and Range Experiment Station. Station pap 66, 1961. 35 p, 12 tab, 20 fig.

Descriptors: *Erosion, *Chaparral, *Planting management, Thunderstorms, *Vegetation effects, Overland flow, Sediment yield.
Identifiers: *Granitic soils, *Hardware-cloth checks, Plant cover, Perennial grass.

This paper discusses the effect of recovery of vegetation, mechanical stabilization, and cover changes on storm runoff, and sediment yields from nine small watersheds located on granitic soils in the lower chaparral zone. Intense summer thunderstorms are characteristic of Arizona. Where plant cover is sparse and infiltration capacity low surface runoff (overland flow) maybe high. Surface flows may carry considerable sediment and generally increase erosion. To control erosion, management must be directed toward reduction of surface runoff. Overland flow and erosion were reduced, and a perennial grass cover was established by cutting woody vegetation, and seeding to Boer and Lehmann lovegrass. Hardware-cloth checks placed on the contour reduced erosion but did not produce additional vegetation. Most surface runoff was produced during the summer.
W69-08474

EROSION AND SEDIMENT MOVEMENT FOLLOWING A WILDFIRE IN A PONDEROSA PINE FOREST OF CENTRAL ARIZONA,
Forest Service (USDA) Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
L. R. Rich.
USDA Forest Service Rocky Mountain Forest and Range Experiment Station, Res Note 76, 1962. 11 p.

Descriptors: *Erosion, *Sediment transport, *Water yield, Ponderosa pine trees, Peak discharge, Sampling, Profiles, Streamflow, Cross-sections.
Identifiers: *Wildfire, Weir basin, Sediment trap, Experimental watersheds.

A hot wildfire burned 60 acres in the upper part of South Fork of Workman Creek Experimental Forest. The fire was not planned, but the watershed instrumentation lent itself to a fairly detailed sampling of fire effects. The fire destroyed 74 percent of the basal area of trees in the burn. The first storm after the fire was one of the most intense measured to that date. During the first summer, under nearly average total rainfall, approximately 1 acre-foot of sediment (an average of 0.016 foot) was eroded from the burn. Sediment was deposited immediately below the burn, in unburned forest vegetation, in the stream channel and in the weir pond. Only 2 percent was trapped in the weir pond, but even this was much more than before the fire. Summer storm peaks were higher than before the fire, but these higher peaks did not result in increased annual streamflow.
W69-08475

GAZING IN RELATION TO RUNOFF AND EROSION ON SOME CHAPARRAL WATERSHEDS OF CENTRAL ARIZONA,
Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
Lowell R. Rich, and Hudson G. Reynolds.
J Range Manage 1963, 16 (6) 322-326, illus.

Descriptors: *Runoff, *Erosion, *Grazing, *Livestock, *Wildlife habitats, Cacti, Shrubs, Watershed management.
Identifiers: *Chaparral watersheds, Forbs, Half-shrubs, Perennial grasses, Experimental watersheds.

Vegetation, water and sediment were measured on four watersheds varying in size from 9.1 to 19.5 acres between 1935 and 1952. Two watersheds were grazed while two served as checks. Precipitation averaged 20.7 inches, streamflow from one ungrazed watershed 1.9 inches and sediment losses averaged 17 to 132 tons per square mile per year. Grazing 80 percent of the growth of perennial grasses reduced their basal cover. Grazing 40 percent of perennial grasses did not adversely affect basal cover. Reduction in basal area of perennial grasses by grazing for conditions measured had no significant or practical effect on total water yield. Proper grazing of perennial grass-shrub complexes in the chaparral of central Arizona had no measurable effect upon water production or erosion.
W69-08476

EFFECT OF GRAZING ON INFILTRATION IN A WESTERN WATERSHED,
Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
J. R. Thompson.
J Soil and Water Conserv 1968, 23 (2): 63-65, illus.

Descriptors: *Infiltration, *Grazing, *Infiltrometers, Soil-water-plant relationships, *Erosion control, Soil management, Soil surfaces, Overland flow.
Identifiers: Infiltration measurements.

Infiltration measurements on grazed and ungrazed watersheds in the fall of 1953, 1954, 1958, and 1963, along with personal observations at other seasons of the year, suggest that seasonal variation in surface soil characteristics of the Badger Wash basin, in western Colorado overshadow any effects that might be attributed to protection from grazing. There are indications that proper soil management to maximize surface fluffiness could effectively reduce erosive runoff from high intensity rainstorms of short duration.
W69-08479

BURNED CHAPARRAL TO GRASS: EARLY EFFECTS ON WATER AND SEDIMENT YIELDS FROM TWO GRANITIC SOIL WATERSHEDS IN ARIZONA,
Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 03B.
W69-08485

AN APPLICATION OF MULTIVARIATE A YSIS TO SEDIMENT NETWORK DESIGN,
Forest Service (USDA), Berkeley, Calif. P
Southwest Forest and Range Experiment Stati
For primary bibliographic entry see Field 07A.
W69-08497

SOME INTERPRETATIONS OF SEDIM SOURCES AND CAUSES, PACIFIC C BASINS IN OREGON AND CALIFORNIA,
Forest Service (USDA), Berkeley, Calif. P
Southwest Forest and Range Experiment Stati
For primary bibliographic entry see Field 02A.
W69-08501

SUMMARY OF FORESTS AND SOIL BILIZATION SESSION,
Forest Service (USDA), Berkeley, Calif. P
Southwest Forest and Range Experiment Stati
Henry W. Anderson.
International Symposium on Forest Hydro
Proc (1965): 701-702 Pergamon Press - O and New York -- 1966.

Descriptors: *Review, *Erosion control, *F soils, *Soil stability, *Landslides, Vegetatio fects, Watershed management.

Summarizes papers presented at the sessio forests and soil stabilization at the Internat Symposium on Forest Hydrology and commen the status of the science. Discusses the r unique characteristics of forest sites and how make for difficulty in evaluating the true sequences of disturbances of forest waters Typically, forest soils are deep or have volumes of loose mantle material, built up the forest vegetation. The surface soil layers high infiltration and percolation capacity; often occupy 'over-steepened' slopes, with th anchored by the tree roots. The 'over-steep slopes imply an erosion process of channel cutting over long periods of time and of mass and occasional mass sliding from lower slope the channels.
W69-08502

IMPORTANT WATERSHED CHA TERISTICS AFFECTING WATER YI FLOOD PEAKS AND EROSION AND SED TATION AND THE BASIC DATA NEEDED PRODUCTION,
Forest Service (USDA), Upper Darby, Northeastern Forest Experiment Station; Forest Service (USDA), Berkeley, Calif. P Southwest Forest and Range Experiment Stati
Howard W. Lull, and Henry W. Anderson.
For 8 Volume Proceedings see Vol 2, No 9, 6B, W69-03305. Int Conf Water for Peace, (1967): 1-8.

Descriptors: *Hydrologic properties, *Wate (Basins), *Analytical techniques, *Water *Peak discharge, *Sediment yield, Erosion c Forecasting, Statistics, Climatic data, Wate management.
Identifiers: *Data needs, *Sediment soc *Watershed variables, Experimental watersh

Predictions of water yield, floods, erosion sedimentation must take into account the en ment factors, the nature of the watershed, past history. Methods of selection and evalua variables which characterize processes deter annual, seasonal and daily water yield anc forecasting are discussed. The variables af flood peak discharge from small watersh discussed under headings of precipitation, ar and geology, topography and land use. Speci ables involved in sedimentation processes a lined. Sources of data and analytical proc are briefly reviewed.
W69-08508

EN IS IT SAFE TO EXTEND A PREDIC-N EQUATION--AN ANSWER BASED UPON TOR AND DISCRIMINANT FUNCTION LYSIS,
st Service (USDA), Berkeley, Calif. Pacific nwest Forest and Range Experiment Station.
primary bibliographic entry see Field 07B.
-08509

IMUM OPERATIONS FOR PLANNING OF OMPLEX WATER RESOURCES SYSTEM,
ornia Univ., Los Angeles. Water Resources er.
primary bibliographic entry see Field 06A.
-08540

SEDIMENTOLOGY OF A BRAIDED ER,
wa Univ., Ontario. Dept. of Geology.
primary bibliographic entry see Field 02J.
-08580

BLE CLUSTERS': THEIR ORIGIN AND LIZATION IN THE STUDY OF AEOCURRENTS,
ara Univ. (Italy). Inst of Geology.
primary bibliographic entry see Field 02J.
-08608

CIAL AND FLUVIO-GLACIAL FORMA-NS OF THE LYON REGION (FRENCH),
n Univ. (France). Dept. of Earth Sciences.
primary bibliographic entry see Field 02C.
-08627

WATER QUALITY MANAGEMENT AND PROTECTION

Identification of Pollutants

Mn, Ni, Co, Sr, Li, Zn, and SILICA IN EAMS OF THE LOWER KANSAS RIVER IN,
sas State Geological Survey, Lawrence; and sas Univ., Lawrence.
. Angino, O. K. Galle, and T. C. Waugh.
tract No PH86-66-63 (FWPCA). Water ources Res, Vol 5, No 3, pp 698-705, June 9. 8 p, 2 fig, 3 tab, 18 ref.

criptors: *Water chemistry, *Trace elements, nsas, Geology, Solutes, Aqueous solutions, , Manganese, Cobalt, Silica, Provenance, Ad-tion, Sampling.
tifiers: *Kansas River Basin, Nickel, Stronti-Lithium, Zinc.

attempt is made to ascertain the background ls and to measure seasonal variations of cted trace and minor elements in the major ams of the Lower Kansas River Basin. wledge of the trace element chemistry of river ers is becoming increasingly more important as rate of use of stream waters increases. Except-the case of strontium, no strong relation veen trace element concentration and geology thology was noted. To ascertain properly trace ient background levels in streams, long-term pling covering at least 1 seasonal cycle is essen-Variations in drainage basin geology have only nor controlling influence on the trace element chemistry of the wastes studied. The low values ickel and cobalt are probably due to adsorption ese elements on the suspended load. (Knapp-iS)
)-08204

NSFER OF OXYGEN IN AQUEOUS SOLU-NS,
roscience, Inc., Leonia, N. J.
in L. Barnhart.
ASCE Proc, J Sanit Eng Div, Vol 95, No SA3, Pap No 6639, pp 645-661, June 1969. 17 p, 11 fig, 5 tab, 24 ref, append.

Descriptors: *Oxygenation, *Dissolved oxygen, *Aqueous solutions, *Water treatment, *Surfactants, Mass transfer, Diffusion, Solubility, Solutes, Boundary processes, Bubbles, Water chemistry, Water temperature.
Identifiers: Oxygen transfer (Bubbling).

The paper reports the results of studies which describe the influence of geometry and temperature on the liquid film coefficient and the mass transfer coefficient for the transfer of oxygen from air bubbles rising in a liquid. It is shown that the liquid film coefficient is related to the total drag force operating at the liquid gas interface. The influences of several surface active agents are discussed. At low concentrations, the principle influence of surface active agents is their effect on the bubble size and rate of rise. (Knapp-USGS)
W69-08217

ODOROUS COMPOUNDS IN NATURAL WATERS-2-EXO-HYDROXY-2-METHYLBORNANE, THE ODOROUS COMPOUND PRODUCED BY SEVERAL ACTINOMYCETES,
California Univ., Berkeley. Col. of Engineering; and California Univ., Berkeley. Dept. of Chemistry.
Lloyd L. Medsker, David Jenkins, and Jerome F. Thomas.
Environ Sci and Tech, Vol 3, No 5, pp 476-477, May 1969. 2 p, 3 fig, 5 ref.

Descriptors: *Water pollution effects, *Odor, *Actinomycetes, Stagnant water, Taste, Water pollution sources, Bacteria, Spectrophotometry, Pollutant identification.
Identifiers: Odor-producing bacteria.

One major odorous constituent in natural waters is the camphor-smelling compound 2-exo-hydroxy-2-methylbornane. Based on a survey of 28 species of Actinomycetes, the findings pinpoint three organisms--Streptomyces antibioticus, Streptomyces praecox, and Streptomyces griseus--as the producers of the odorous constitutent. (Knapp-USGS)
W69-08219

OLEFINS OF HIGH MOLECULAR WEIGHT IN TWO MICROSCOPIC ALGAE,
Houston Univ., Tex. Dept. of Chemistry; Houston Univ., Tex. Dept. of Biology; and Houston Univ., Tex. Dept. of Biophysical Sciences.
E. Gelpi, J. Oro, H. J. Schneider, and E. O. Bennett.
Science, Vol 161, No 3842, pp 700-701, August 1968. 2 fig, 1 tab, 23 ref.

Descriptors: *Algae, Cyanophyta, Chrysophyta, Cultures, Diagenesis, Sediments, Gas chromatography, Lipids, Oil, Oil shale.
Identifiers: *Botryococcus braunii, *Anacystis montana, *Hydrocarbons, *Olefins, Green River formation, Chlorophyll derivatives, Recent sediments, Precambrian sediments, Chlorella pyrenoidosa, Fucales, Alkanes, Alkenes, Aliphatic hydrocarbons, Petroleum crudes, Mass spectrometry, N-heptadecane, Monoenes, Dienes, Trienes.

Utilizing gas chromatography and mass spectrometry, authors studied the hydrocarbon composition of two species of algae: Botryococcus braunii, a golden-brown (chrysophyte), and Anacystis montana, a blue-green (cyanophyte). Hydrocarbons of the chrysophyte are alkenes with one, two, or three double bonds; and odd numbers of carbon atoms (in range, 17-33). Diolefins with 27, 29 or 31 carbon atoms predominate, that of 29 carbons being major component. Distribution in the cyanophyte comprises primarily monoenes with carbon atoms in range, 19-29, the major component being a monoene of 27 carbons. Heptadecane, only paraffin found, constituted 11.5% of hydrocarbons found in anacystis. Consideration of information developed in this study, together with data reported elsewhere in the literature, led authors to the following conclusions: hydrocarbons of high molecular weight are found in contemporary counterparts of ancient microscopic organisms; such hydrocarbons are present in high cellular concentrations (0.1-0.3% of dry cell weight); they possess high degree of unsaturation; they show marked odd over even predominance; and they show actual and potential similarities with patterns of ancient and modern sediments and oil shales. (Eichhorn-Wis)
W69-08284

DETERMINATION OF TOTAL NITROGEN IN WATER BY MICROCOULOMETRIC TITRATION,
Dohrmann Instruments Co., Mountain View, Calif.
Robert T. Moore, and James A. McNulty.
Environ Sci and Tech, Vol 3, No 8, p 741-744, Aug 1969. 4 p, 5 fig, 2 tab, 5 ref.

Descriptors: *Analytical techniques, *Chemical analysis, *Water analysis, *Nitrogen compounds, Organic compounds, Nutrients, Nitrates, Chromatography, Ammonia, Gas chromatography.
Identifiers: Nitrogen analysis, Microcoulometric titration.

A new and rapid instrumental technique has been developed to measure the total of both organically and inorganically bound nitrogen in water. Conceived as a replacement for normal Kjeldahl procedures, the sytem yields duplicate analyses down to 0.2 ppm in under 10 min. The sample is pyrolyzed over a granular nickel catalyst in a stream of humidified hydrogen, the bound nitrogen in the sample being converted quantitatively to ammonia and subsequently titrated electrochemically in a pH-sensitive cell. Suitable for use with partitioning procedures, specific scrubbers, and gas chromatography, the technique is capable of rapidly revealing the organic and inorganic nitrogen spectrum in water samples. Equivalent results are obtained where the sample matrices are the typical hydrocarbons used in partitioning. (Knapp-USGS)
W69-08559

NATURAL AND POLLUTION SOURCES OF IODINE, BROMINE, AND CHLORINE IN THE GREAT LAKES,
Michigan Univ., Ann Arbor. Dept. of Meteorology and Oceanography.
Mary A. Tiffany, John W. Winchester, and Ronald H. Loucks.
J Water Pollut Contr Federation, Vol 41, No 7, p 1319-1329, July 1969. 11 p, 10 fig, 5 tab, 13 ref. Contract No AT (11-1)-1705AEC).

Descriptors: *Water quality, *Great Lakes, *Trace elements, *Water pollution effects, Chlorides, Halogens, Algae, Water pollution sources, Water chemistry, Water analysis.
Identifiers: *Bromine, *Iodine.

This study involves the determination of trace elements I, Br, and Cl in the Great Lakes, using neutron activation analysis of 90 water samples from Lake Superior and its tributary streams, Lake Michigan, southern Lake Huron, Lake St. Clair, western Lake Erie, and northern Lake Ontario. Possible pollution by bromine through an atmospheric route is of interest because of the combustion of leaded gasoline. Iodine deficiency in lake water may be related to thyroid disorders among marine fish which have become adapted to fresh water, and algae may offer competition for the available iodine. Chlorine is a noticeable contaminant except in Lake Superior. The Lake Superior streams appear to represent a good average of the atmospheric inputs of I, Br, and Cl. (Knapp-USGS)
W69-08562

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5B. Sources of Pollution

SEWAGE DISPOSAL SYSTEMS NEAR SHORELINES.
For primary bibliographic entry see Field 05E.
W69-08154

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO V UNITED STATES STEEL CORPORATION (INDUSTRIAL WATER POLLUTION).
For primary bibliographic entry see Field 05G.
W69-08172

PLANT NUTRIENTS IN BASE FLOW OF STREAMS IN SOUTHWESTERN WISCONSIN,
Wisconsin Univ., Madison.
Neal Minshall, M. Starr Nichols , and S. A. Witzel.
Grant V.I. 00556-04 HEW, Grant 14-01-0001-858 OWRR. Water Resources Res, Vol 5, No 3, pp 706-713, June 1969. 8 p, 1 fig, 1 tab, 9 ref.

Descriptors: *Water chemistry, *Solutes, *Nutrients, *Base flow, *Wisconsin, Nitrogen compounds, Phosphorus compounds, Potassium compounds, Provenance, Leaching, Weathering, Runoff.
Identifiers: Wisconsin River.

A 2-yr study was made of plant nutrients in the base flow of SW Wisconsin streams. The average base flow from 36 drainage areas covering a total of 643 sq mi was 4.9 in/yr. The annual nutrient losses in base flow were nitrogen, 1.1 lbs/acre; phosphorus, 0.10 lb/acre; and potassium, 1.8 lbs/acre. These losses were only 1/4 of those in the 1967 surface runoff from 0.01-acre plots at the Lancaster Experimental Farm and 3 Agricultural Research Service watersheds near Fennimore, Wisconsin. If precipitation of about 32 in. in a normal year, contains 10 lbs N/acre, fetrilizer applications 20 lbs N/acre, and subsurface or base flow an average of only 1 lb N/acre, then the other 29 lbs must be lost in surface runoff, retained for plant growth, or lost through denitrification. Total P lost per year, in the base flow was 0.1 lb/acre, which is approximately 2% of the amount applied and only 1/10 of that lost in the 1967 spring surface runoff from the Lancaster plots and Fennimore watersheds. Soluble K lost per year in the base flow was about 2 lbs/acre, about 10% of that applied and only 1/4 of that lost in the 1967 spring surface runoff. (Knapp-USGS)
W69-08205

ENVIRONMENTAL PROTECTION FOR NUCLEAR APPLICATIONS,
Harvard School of Public Health, Boston, Mass. Kresge Center for Environmental Health.
For primary bibliographic entry see Field 05G.
W69-08212

STATUS OF RADIOACTIVE WASTE DISPOSAL IN U.S.A.,
Vanderbilt Univ., Nashville, Tenn. Dept. of Sanitary and Water Resources Engineering.
For primary bibliographic entry see Field 05E.
W69-08214

ODOROUS COMPOUNDS IN NATURAL WATERS-2-EXO-HYDROXY-2-METHYLBORNANE, THE ODOROUS COMPOUND PRODUCED BY SEVERAL ACTINOMYCETES,
California Univ., Berkeley. Col. of Engineering; and California Univ., Berkeley. Dept. of Chemistry.
For primary bibliographic entry see Field 05A.
W69-08219

AN APPRAISAL OF WATER POLLUTION IN THE LAKE SUPERIOR BASIN.
Federal Water Pollution Control Administration, Chicago, Ill. Great Lakes Region.
For primary bibliographic entry see Field 05C.
W69-08220

SOME EFFECTS OF PESTICIDES ON MISSISSIPPI WATERS,
Mississippi Game and Fish Commission, Jackson. Fisheries Div.
For primary bibliographic entry see Field 05C.
W69-08222

AN ESTIMATE OF THE RESPONSE RATE OF ALBACORE TO CESIUM,
Scripps Institution of Oceanography, La Jolla, Calif.
T. R. Folsom, D. R. Young, and C. Sreekumaran.
Symp on Radioecology, Proc 2nd National Symp, May 15-17, 1967, Ann Arbor, Mich, Nelson, Daniel J and Evans, Francis C (eds). US Atomic Energy Comm, Doc CONF 670503, pp 337-345. 3 fig, 2 tab, 17 ref, disc. Available from Clearinghouse as CONF 670503 at $3.00 in paper copy and $0.65 in microfiche.

Descriptors: *Cesium, *Pacific Ocean, *Mathematical models, Migration, California, Oregon, Gamma rays, Spectrometers, Sea water.
Identifiers: *Thunnus germo, *Response rate, *Cesium-137, Muscle, Biological half-life, Accumulation ratio, Half-life, Sand, Scripps Institution of Oceanography.

A general form of mathematical framework has been adopted for connecting dynamic behavior and ultimate equilibrium in large oceanic fish, with possible convenience for testing hypotheses concerning migration rates and environmental factors. Formulas suggest that albacore may respond to changes in cesium rapidly and may accumulate relatively high levels. If albacore environment can be approximated by surface concentrations, biological half-life of their cesium appears to be less than 100 days. Ocean surface waters apparently are not dominant sources of cesium-137 experienced by albacore. Fallout cesium has been observed to be concentrated in surface-living fish classes, probably serving as food for tunas. Fraction of cesium entering tuna through the stomach is unknown. Large differences in concentration of cesium-137 between those typical in the Western Pacific and in surface waters near California suggested significant changes in radiocesium environment of certain albacore during migration. Available evidence suggested that large surface concentrations persisted to 200-meter depths, part of albacore's environment. Intense concentrations of fallout cesium persisting at depths near 100 meters were discovered. Organisms supporting tuna food-chain penetrate these layers daily. Albacore themselves may visit these layers frequently. (See Vol. 2, No. 18, Field 5C, W69-07441). (Jones-Wis)
W69-08271

STATE OF NEW HAMPSHIRE V ATOMIC ENERGY COMM'N (EVIDENCE OF POSSIBLE THERMAL POLLUTION NOT WITHIN JURISDICTION OF AEC).
For primary bibliographic entry see Field 05G.
W69-08316

MISCELLANEOUS PROVISIONS (UNLAWFUL DISCHARGE OF OIL IN CHARLESTON HARBOR).
For primary bibliographic entry see Field 05G.
W69-08373

CHEMICAL CHANGES IN COOLING WATER TOWERS,
Central Electricity Generating Board, Barnet (England). Research and Development Dept.
I. Davies.
Air and Water Pollution Int. Journal Vol 10, pp 853-863, Pergamon Press, 1966. 11 p, 4 tab, 11 ref.

Descriptors: *Cooling water, *Cooling tower, *Regression analysis, Evaporation, Dissolved oxygen, Circulation, Hardness (Water), Oxidation, Aeration, Water chemistry.
Identifiers: Intake, Outlet, England, Make-up water.

The chemical changes which occur in the w used in cooling towers have been studied using from six English power stations. Simple concen tion without chemical change occurs in many stances. The extent of concentration depen upon operating conditions. The carbon dioxid scrubbed out of the water giving changes in h ness and pH. Ammonia is converted into nitr The water is aerated and part of the oxidizable purities destroyed. Suspended solids settle out, where sewage effluent is the source of make some suspended solids are formed. (Sherman-V derbilt)
W69-08402

ANALYZING STEAM POWER PLA DISCHARGES,
Vanderbilt Univ., Nashville, Tenn.; and Johns H kins Univ., Baltimore, Md.
J. E. Edinger, and J. C. Geyer.
Journal of the Sanitary Engineering Divis ASCE Vol 94, No SA4, Proc. Paper 6064, pp 6 623, Aug 1968. 23 p, 2 tab, 5 fig, 4 ref.

Descriptors: *Energy equation, *Heat trans *Diffusivity, *Thermal pollution, *Mathemat model, Heat, Thermodynamic behavior, Spec heat, Latent heat, Solar radiation, Conduct Evaporation, Vapor pressure, Wind velocity, F rates, Cooling water, Heated water.
Identifiers: *Thermal exchange coeffici *Equilibrium temperature, *Temperature distri tion, Analytic solution, Back radiation, Conv tion, Stefan-Boltzmann law, Atmospheric ra tion, Reflected radiation, Field data, Hea discharge, Power generation.

The temperature distribution resulting from the vection, dispersion, and cooling of water fro steam electric power plant condenser is analy for a station located on a peninsula and discharg near the midpoint of a small narrow estuary theoretical temperature distribution equatio developed and used to predict the mean mon temperatures to be expected within a mile of discharge point for various levels of operat Temperatures are related to an equilibrium perature toward which water temperatures driven by meteorological conditions. (Motz-V derbilt)
W69-08411

FORECASTING HEAT LOSS IN PONDS STREAMS,
Michigan Univ., Ann Arbor. Dept. of Environr tal Health.
C. J. Velz, and J. J. Gannon.
Journal of Water Pollution Control Federation, 32, No 4, p 392-417, Apr 1960. 26 p, 20 fig, 3 22 ref.

Descriptors: *Thermal pollution, *Heat *Waste assimilative capacity, *Energy bu Waste storage lagoon, Cooling water, Meteorol variables, Hydrologic variables, Aquatic life, W reuse, Steam power plants, Solar radiation, temperature, Wind velocity, Atmospheric v pressure, Drought flow, Statistical method, Pr bility.
Identifiers: Stream sanitation, Waste heat, Co pond, Evaporation loss, Convection loss, Radi loss, Equilibrium water temperature.

This paper deals with methods of forecasting dissipation and the corresponding water tem ture profile expected along the course of receiving stream. The meteorologic and hydro variables involved are defined in statistical t making it possible to assign a probability of o rence to any forecast of water temperature p developed. Two practical applications are trated: (a) use of a wastewater storage lagoon cooling pond for reuse of the water and (b) u river for dissipation of waste heat. This provid advance in stream sanitation evaluation de with an increasing variety of waste heat prob including site selection for industries and s power plants. (Ross-Vanderbilt)
W69-08415

ACE DISCHARGE OF HORIZONTAL M-WATER JET,
Jen, R. L. Wiegel, and Ismail Mobarek.
S Grant R6-5445. Journal of the Power Divi-American Society of Civil Engineers, Vol 92, 2, Apr 1966, p 1-30. 15 fig, 4 tab, 15 ref.

ptors: *Jets, *Mixing, *Power plants, Circu- Cooling water, Testing, Flow, Thermal pol- Model studies, Flow profiles, Diffusion.

atory experiments were performed to study of a heated (buoyant) jet of water rged horizontally into a still ambient fluid at rface. Ranges of jet temperature excess the ambient fluid were 0 deg. to 35 deg. F; netric Froude numbers ranged from 18 to nd Reynolds numbers from 8300 to 21,000. red distributions were compared with an ap- nate theory based on earlier work on sub- d jets. Necessary coefficients were evaluated manner. Surface temperatures along the line approximately adhere to the theory for 100 diameters downstream. Beyond this mixing occurred more rapidly than pre- Equations and data are presented. Though rface temperature distribution on the center- as found similar to that for submerged jets, lateral mixing than vertical occurs to bring out. Bottom slopes of the jet were found to etween 12.5 and 18 percent. (Benedict-Van- t)
08421

ULENT BOUYANT JETS INTO TIFIED OR FLOWING AMBIENT DS,
rnia Inst. of Tech., Pasadena.
ien Fan.
S WP-00428 and WP-00680. FWPCA Grant 1256-01. W M Keck Laboratory of Hydrau- nd Water Resources, Report No KH-R-15, 967. 196 p, 25 ref.

iptors: *Density stratification, *Jets, *Cur- (Water), Hydraulics, Flow, Pressure drag, nal pollution, Diffusion, Flow characteristics, profiles, Turbulence.
fiers: *Bouyant jets, Entrainment, Concen- n profiles, Marine sewage disposal.

retical and experimental studies have been icted for two cases: (1) a round bouyant jet in nant environment with linear density stratifi-, and (2) a round bouyant jet in a uniform stream of homogeneous density. Use of the al approach yielded a theoretical solution for agnant environment which proved satisfacto- a constant entrainment coefficient, alpha, of was used. For a uniform cross stream, an in- analysis was carried out assuming an entrain- mechanism based on the vector difference of d ambient velocities. A gross drag term with a nt drag coefficient, Cd, was developed to ex- the effect of the unbalanced pressure field on les of the jet. Values for Cd and alpha were by matching measured paths and dilution to the theoretical model. Self-generated, than ambient, turbulence was found to con- t behavior up to about 250 diameters. Con- tion profiles have also been measured and sed, with similarity noted and maximum con- tions of 60-80 percent greater than center- lues observed. (Benedict-Vanderbilt)
08423

RICAL SOLUTIONS OF TURBULENT ANT JET PROBLEMS,
nia Inst. of Tech., Pasadena.
ien Fan, and Norman H. Brooks.
A 16070 DGY. W M Keck Laboratory of ulics and Water Resources, California In- of Technology, Report No. KH-R-18, Jan 04 p, 46 fig, 1 photo, 25 ref.

ptors: *Jets, *Density stratification, Diffu- lixing, Thermal stratification, Outlets, Waste n, Waste water disposal.
Identifiers: *Bouyant jets, *Forced plumes, Ocean outfalls.

Theoretical solutions were obtained on four classes of turbulent bouyant jet problems, namely, (1) an inclined, round bouyant jet in a stagnant, uniform ambient fluid; (2) an inclined, round bouyant jet in a stagnant ambient fluid with linear density-stratification; (3) an inclined, slot bouyant jet in a stagnant, uniform ambient fluid; (4) an inclined, slot bouyant jet in a stagnant ambient fluid with linear density-stratification. This report is a summary of the numerical solutions on bouyant jets in stagnant environments carried out in connection with previous investigations by Fan, Fan and Brooks, and Brooks and Koh. Using the integral type of analysis, assuming similarity, predictions can be made for jet trajectory, widths, and dilution ratios, in a uniform or density-stratified environment without ambient currents. Numerical solutions have been presented in dimensionless form for a wide range of initial conditions including the effect of the initial angle of discharge. Problems with non-linear density profiles are not readily treated in generalized non-dimensional form. Rather it is more feasible to make case by case calculations using dimensional variables. A program for such calculations for a round jet is available in a technical memorandum by Ditmars. These solutions are useful in the design of disposal systems for sewage effluent into the ocean or cooling water into a lake.
W69-08424

WATER QUALITY AS AFFECTED BY A WYOMING MOUNTAIN BOG,
Forest Service (USDA), Laramie, Wyo. Rocky Mountain Forest and Range Experiment Station.
David L. Sturges.
Water Resources Research, 1967, 3 (4): 1085-1089, Illus.

Descriptors: *Water quality, *Bogs, *Chemical properties, *Physical properties, *Coliforms, Groundwater, Perennial streams, Peat, Potable water, Fen, Wyoming.
Identifiers: Seasonal changes in water quality.

Waters collected July through October 1965 at a Wyoming mountain bog were analyzed for potability and seasonal changes in calcium, magnesium, potassium, iron, and silica. Four locations were sampled: effluent stream, fissure locations in the bog, peat locations in the bog, and ground water. The color and turbidity of peat water greatly exceeded that at other locations and the maximum levels established by the U. S. Public Health Service for drinking water. The dissolved mineral content of all waters was very low, and the waters were of excellent chemical quality. All waters contained coliform organisms, probably of a nonfecal origin in peat and fissure water. The concentration of minerals in peat water remained constant through the sampling period. Mineral concentrations in ground water increased in September, when the water table was at a seasonal minimum, but decreased in October following water table recharge. Silica levels were higher than other ions at all locations; the highest levels were in peat water.
W69-08455

GROSS ALPHA AND BETA RADIATION IN WATERS AT A WYOMING MOUNTAIN BOG,
Forest Service (USDA), Laramie, Wyo. Rocky Mountain Forest and Range Experiment Station.
David L. Sturges, and Robert E. Sundin.
Water Resources Research, 1968, 4 (1): 159-162, Illus.

Descriptors: *Fallout, *Radioisotopes, *Groundwater, *Perennial streams, *Snowpack, *Bogs, Fen, Wyoming.
Identifiers: Gross alpha radiation, Gross beta radiation, Radionuclide filtration.

Waters collected between July and October 1965 from four locations at a mountain bog were analyzed for radiologic content. The gross alpha and beta content of waters was less than 5 and 10 pc/liter, respectively. Gross beta activity of filterable solids in ground water collected above the bog reached 400 pc/gram when the water table was at a seasonal minimum, but on other dates and at bog and stream locations, the gross beta activity of filterable solids was less than 100 pc/gram. Radiation levels in waters from snow, overland flow, and stream sources were measured in May, June, or October 1965. Snow water activity was less than 25 pc/liter, but filterable solids had a maximum gross alpha and beta activity of 243 and 1348 pc/gram, respectively. Standing vegetation, litter, and moss on the bog surface screened radionuclides from snowmelt water. Radionuclide filtration on watersheds is significant from a public health standpoint.
W69-08457

EFFECT OF A WATERSHED TREATMENT WITH PICLORAM ON WATER QUALITY,
Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
E. A. Davis, P. A. Ingebo, and C. P. Pase.
USDA Forest Serv Res Note RM-100, 4 p. 1968.

Descriptors: *Herbicides, *Water pollution, *Pesticide residues, *Brush control, Pesticides, Brush, Soil treatment, Watershed management, Forest management, Agricultural chemicals, Chemicals, Pesticide toxicity, Chaparral, Water quality, Wildlife, Aquatic life.
Identifiers: *Picloram, Woody plant control.

A soil application of picloram pellets (9.3 lb. acid equivalent per acre), on a 2-acre side drainage of a 46 acre chaparral watershed in central Arizona, resulted in the movement of detectable amounts of picloram into the stream water. The highest concentration of picloram found was 0.37 ppm; this concentration occurred after a 2.53-inch rainstorm 5 days after treatment. The extent of movement of picloram into the stream water was related to rainfall duration and amount. After a total of 40 inches of rain during a 16-month period, picloram was no longer detected in the stream water. Possible effects of watershed treatments with picloram on livestock, wildlife, aquatic organisms, and irrigated crops are considered.
W69-08484

TREATING WASTES IN A WATER-SHORT AREA,
Texas Technological Coll., Lubbock.
For primary bibliographic entry see Field 05D.
W69-08551

WATER POLLUTION CONTROL IN THE TEXTILE INDUSTRY,
American Textile Manufactures Inst., Charlotte, N. C.; and Burlington Industries, Inc., Greensboro, N. C.
For primary bibliographic entry see Field 05G.
W69-08552

BACTERIOLOGICAL WATER QUALITY OF SEVERAL RECREATIONAL AREAS IN THE ROSS BARNETT RESERVOIR,
Southeast Water Lab., Athens, Ga.; and Mississippi Air and Pollution Control Board, Jackson.
R. D. Barbaro, B. J. Carroll, L. B. Tebo, and L. C. Walters.
J Water Pollut Contr Federation, Vol 41, No 7, p 1330-1339, July 1969. 10 p, 6 fig, 5 tab, 11 ref.

Descriptors: *Water quality, *Bacteria, *Coliforms, *Reservoirs, *Mississippi, *Recreation, Swimming, Boating, Water pollution sources, Water pollution effects.
Identifiers: *Ross Barnett Reservoir, Jackson (Miss).

Two 24-hr studies were conducted at the Ross Barnett Reservoir near Jackson, Mississippi. One was

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during a period of high recreational activity (July 4, 1966) and the other during a period of relatively normal use (August 2, 1966). Ten reservoir stations, located in areas of most intense recreational use, were sampled for total coliform, fecal coliform, and fecal streptococci. No statistical difference was observed in total coliform counts, either between the days or among the stations on a given day; however, fecal coliform and fecal streptococci data showed significant variation, reflecting their suitability as indicator organisms. (Knapp-USGS)
W69-08563

BIOLOGICAL CONCENTRATION OF PESTICIDES BY ALGAE,
North Texas State Univ., Denton. Dept. of Biology.
For primary bibliographic entry see Field 05C.
W69-08565

5C. Effects of Pollution

AN APPRAISAL OF WATER POLLUTION IN THE LAKE SUPERIOR BASIN.
Federal Water Pollution Control Administration, Chicago, Ill. Great Lakes Region.

Fed Water Pollut Contr Admin, Great Lakes Reg Rep, Apr 1969. 107 p, 7 fig, 3 tab, 56 ref, 3 append.

Descriptors: *Water pollution, *Lake Superior, *Water quality control, *Water quality act, Waste treatment, Sewage treatment, Legislation, Water management (Applied).
Identifiers: *FWPCA.

Studies of the water quality and pollution problems of the Lake Superior basin made by FWPCA and cooperating agencies are summarized. The esthetic value of Lake Superior is of major importance. Increases in the range of 2-50 ppb of heavy metals such as copper, chromium, zinc, and cadmium will have lasting deleterious effects upon the lake. The exteme clarity and cold temperature of the waters of Lake Superior are a necessity to support its present ecology. Lake Superior is an oligotrophic lake, but nutrient values in some areas of the lake have been reported at levels approaching those commonly associated with nuisance algal growths, but other factors, such as temperature, are limiting. Municipal and industrial wastes with high concentrations of BOD has caused oxygen depletion in the St. Louis River, Duluth--Superior harbor, and Montreal River. The deposition of polluted dredgings contributes to the degradation in quality of Lake Superior. It is recommended that quality criteria reflect more appropriately the uniqueness of the lake. Secondary biological waste treatment should be provided by all municipalities. Existing combined sewers should be separated. (Knapp-USGS)
W69-08220

MISSISSIPPI WATER RESOURCE CONFERENCE - 1969.
Mississippi State Univ., State College. Water Resources Research Inst.
For primary bibliographic entry see Field 02E.
W69-08221

SOME EFFECTS OF PESTICIDES ON MISSISSIPPI WATERS,
Mississippi Game and Fish Commission, Jackson. Fisheries Div.
C. Rex Bingham.
Proc Miss State Univ Water Resources Res Inst Conf, Apr 8-9, 1969, pp 63-71, 1969. 9 p, 4 tab, 8 ref.

Descriptors: *Pesticides, *Water pollution sources, *Mississippi River, *Mississippi, Fishkill, Pesticide toxicity, DDT, Phosphothioate pesticides.
Identifiers: Yazoo River (Miss).

Wolf Lake and Mossy Lake, in the Mississippi Delta, were sampled to study the amounts of pesticides in the water and sediment and the effect of pesticides on fish. DDT, TDE, and DDE were found on 15 of 15 sampling dates in Wolf Lake and on 11 of 15 in Mossy Lake. Toxaphene was found 10 of 15 days in Wolf Lake and 1 of 15 days in Mossy Lake. Methyl parathion was found in both lakes on 2 days. Pesticide concentrations were low to medium in February to early March, peaked in the spring, declined in the summer, and rose in autumn. Bluegills in Mossy Lake averaged 1.013 ppm DDT, and in Wolf Lake, 5.041 ppm. Largemouth Bass were planted in Wolf Lake but did not survive, possibly because of pesticides. (See W69-08221). (Knapp-USGS)
W69-08222

INFLUENCE OF ENVIRONMENTAL FACTORS ON THE CONCENTRATIONS OF Zn-65 BY AN EXPERIMENTAL COMMUNITY,
Bureau of Commercial Fisheries, Beaufort, N. C. Radiobiological Lab.
T. Duke, J. Willis, T. Price, and K. Fischler.
Available from Clearinghouse as CONF 670503 at $3.00 in paper copy and $0.65 in microfiche. Symp on Radioecology, Proc 2nd National Symp, May 15-17, 1967, Ann Arbor, Mich, Nelson, Daniel J and Evans, Francis C (eds). US Atomic Energy Comm, Doc CONF 670503, pp 355-362. 3 fig, 1 tab, 18 ref.

Descriptors: *Zinc radioisotopes, *Environmental effects, Salinity, Temperature, Sea water, Oysters, Clams, Crabs, North Carolina, Sediments, Radioactivity, Marine animals, Estuarine environment, Fallout, Nuclear explosions, Biota, Spectrometers, Bacteria, Algae, Sands, Hydrogen ion concentration.
Identifiers: *Concentrations, Aequipecten irradians, Pivers Island (N C), Detector, Beaufort (N C), Crassostrea virginica, Mercenaria mercenaria, Panopeus herbstii.

Capacity of organisms to concentrate elements from seawater is affected by changes in environmental factors that alter the physiological condition of the organisms or the physical-chemical properties of elements. This knowledge is needed to evaluate potential hazards from radioactive pollution. Zinc-65 (Zn-65) enters the biochemical cycle of the estuarine environment in fallout from nuclear weapons and in effluent from nuclear reactors, occurring in measurable amounts in estuarine biota, sediments, and water. A polyfactorial approach is required to study the concentration of radioisotopes. Differences in salinity, temperature, pH, and zinc in seawater significantly affected the concentration of Zn-65 of a community of oysters, clams, mud crabs, and scallops, and their sediment substrate. A factorial analysis of variance showed no interactions among the environmental factors. High salinity and zinc concentration suppressed the concentration of Zn-65 in animals and sediment, whereas high temperature and pH HAD THE OPPOSITE EFFECT. Temporal variation in concentration factors for control animals and sediment was significant during the experiment. Such variation must be considered when reporting concentration factors for radionuclides in marine organisms. Data from this experiment represent a first step toward prediction of the fate of a radioisotope released into an estuary. (See Vol. 2, No. 18, Field 5C, W69-07441). (Jones-Wisc)
W69-08267

THE CONCENTRATION OF Zn-65 BY OYSTERS MAINTAINED IN THE DISCHARGE CANAL OF A NUCLEAR POWER PLANT,
Washington Univ., Seattle. Fisheries Research Inst.; and Inter-American Tropical Tuna Commission, La Jolla, Calif.
Ernest O. Salo, and William L. Leet.
Available from Clearinghouse as CONF 670503 at $3.00 in paper copy and $0.65 in microfiche. Symp on Radioecology, Proc 2nd Natl Symp, May 15-17, 1967, Ann Arbor, Mich, Nelson, Daniel J and Evans, Francis C (eds). US Atomic Energy Co
Doc CONF 670503, pp 363-371, 4 fig, 1 tab, 3 disc.

Descriptors: *Zinc radioisotopes, *Oys
*Nuclear powerplants, *Discharge (Wa
Radioactive wastes, Absorption, D
Radioisotopes, California, Manganese, Co
Cesium, Gamma rays, Background radiation,
dicators, Sedimentation, Temperature,
Chromium.
Identifiers: *Concentration, Humboldt Bay (Ca
Maximum permissible body burden, Eur
California, Half-life.

Zinc-65 (Zn-65) accumulation was measure
oysters bedded in discharge canal of Pacific
and Electric Company's Humboldt Bay Po
Plant (nuclear-powered electric). Oysters of
1962 and 1964 brood were reared on
suspended from a raft, facilitating exposure
radioactive wastes discharged from the plant
this canal. Monthly average concentrations of
65 in the waters of the discharge canal during
study ranged from 1.04 to 19.63 femtocuries/
liliter. Oysters were sampled as new groups
added, for over 400 days. Concentration of Zn
in the wet meats of the oysters varied from 0.9
174.0 picocuries/gram. Changes in concentrat
of Zn-65 in oysters followed changes of Zn-6
discharge waters. Concentration for the
brood ranged from 5600 to 12,000, and from 8
to 11,000 for the 1964 brood. Assuming cons
pumping and filtering rates for the oysters, a fa
for efficiency of absorption was determined to
less than 0.4% for the 1964 brood. Human pro
diet of oysters raised in canal would provide
imum concentration well within permissible
burden. (See Vol. 2, No. 18, Field 5C, W
07441). (Jones-Wisc)
W69-08268

**DISTRIBUTION OF RADIONUCLIDES IN
ENVIRONMENT OF ENIWETOK AND BIK
ATOLS, AUGUST 1964,**
Washington Univ., Seattle. Coll. of Fisheries.
A. D. Welander.
Symp on Radioecology, Proc 2nd Natl Symp,
15-17, 1967, Ann Arbor, Mich, Nelson, Dani
and Evans, Francis C (eds). US Atomic En
Comm, Doc CONF 670503, pp 346-354. 8 ta
ref, disc. Available from Clearinghouse as C
670503 at $3.00 in paper copy and $0.6
microfiche.

Descriptors: *Radioisotopes, *Distribu
Animals, Plants, Bottom sediments, Soils, Nuc
explosions, Cobalt radioisotopes, Cesium, Str
um radioisotopes, Manganese, Algae, Iron, B
Radioactivity, Invertebrates, Plankton, Fish,
water, Gamma rays, Radiochemical analysis,
um, Carbon radioisotopes, Biota, Clams, Fal
Pacific Ocean, Spectrometers.
Identifiers: *Eniwetok Atoll, *Bikini A
Ruthenium-106, Antimony-125, Groundw
Bismuth-207, Vertebrates, Plutonium-239, 1
Zirconium-95-Niobium, Europium-155, S
110m, Cerium, Guettarda, Ipomoea, Pisonia,
danus, Muscle, Bone, Leaves, Shell, Rhodium-

Radionuclide analyses were made of more
2000 samples of animals, plants, water, bo
sediments, and soils, collected at Eniwetok
Bikini Atolls, site of 59 nuclear tests between 4
and 1958. Cobalt-60 was found in all sample
was dominant in the marine environment. Ces
137 (Cs-137) and Strontium-90, how
predominated in terrestrial environments. All
ples contained traces of manganese-54, alth
there were slightly larger amounts of
radionuclide in land plants and land inverteb
Ruthenium-106 and antimony-125 were det
in significant amounts in groundwater and soil
traces in animals and plants. Trace amoun
bismuth-207 were also found in most samples
Cerium-144 usually in algae, soils and land p
There were comparatively large amounts of ir
in a number of samples, especially in verteb

onium-239 was found in soil and in skins of rats birds, in the few samples analyzed. Soils con-ed highest levels of radioactivity, followed by rtebrates, groundwater, shorebirds, plants, plankton, algae, fish, bottom sediments, sea-r, and seabirds. In land samples, Cs-137 ed to be best measure of distribution of activity in bioenvironmental samples. Highest activity was found in samples collected near sites. (See Vol. 2, No. 18, Field 5C, W69-1). (Jones-Wis)
-08269

IOZINC DECLINE IN STARRY FLOUN-S AFTER TEMPORARY SHUTDOWN OF FORD REACTORS,
gon State Univ., Corvallis. Dept. of Oceanog-y.
am C. Renfro and Charles Osterberg.
p on Radioecology, Proc 2nd National Symp, 15-17, 1967, Ann Arbor, Mich, Nelson, el J and Evans, Francis C (eds). US Atomic gy Comm, Doc CONF 670503, pp 372-379. 4 tab, 7 ref, disc. Available from Clearinghouse ONF 670503 at $3.00 in paper copy and $0.65 icrofiche.

criptors: *Zinc radioisotopes, *Nuclear reac-Columbia River, Washington, Estuaries, activity, Salinity, Gamma rays, Chromium, ments, Biota, Radioecology, Trophic level, trometers, Temperature.
tifiers: *Platichthys stellatus, *Hanford sh), Ecological half-life, Effective half-life, centrations, Biological half-life, Neptunium-

ctives were to relate zinc-65 (Zn-65) concen-ons to trophic position, to examine variance in 5 concentrations, and measure zinc turnover. 5 concentrations and total zinc were measured tarry flounders collected periodically over a year period from Alder Slough, a small arm of Columbia River Estuary. Nuclear reactors at ford, Washington, which supply most of Zn-65 e river were shut down for 45 days during this od, resulting in greatly reduced input of activity to the study area, and specific activity crocuries Zn-65 per gram total Zn) in flounders ined. Time required to reduce specific activity n-65 by one-half, under conditions in which the nders continued to obtain Zn-65 from their web and water, is termed 'ecological half-life'. logical half-life' for Zn-65 in juvenile starry nders was 139 days under the conditions ailing in this study. Effective half-lives of Zn-n three flounders held in the laboratory were 91, and 162 days, depending on initial concen-on of Zn-65 in each test fish. Determinations of ific activities and 'ecological half-lives' would f prime importance in case of acute radioactive amination of an ecosystem. (See Vol 2, No. 18, d 5C, W69-07441). (Jones-Wis)
9-08270

ASUREMENTS OF BACKGROUND RADIA-N IN AQUATIC HABITATS IN ALASKA,
tmouth Coll., Hanover, N. H. Dept. of Biologi-Sciences; and Army Terrestrial Sciences ter, Hanover, N. H.
. Likens, and P. L. Johnson.
p on Radioecology, Proc 2nd Natl Symp, May 7, 1967, Ann Arbor, Mich, Nelson, Daniel J Evans, Francis C (eds). US Atomic Energy m, Doc CONF 670503, pp 319-328. 3 fig, 2 21 ref, disc. Available from Clearinghouse as NF 670503 at $3.00 in paper copy and $0.65 in ofiche.

criptors: *Background radiation, *Aquatic tats, *Alaska, Lakes, Rivers, Hot springs, Ter-ial habitats, Depth, Air, Sediments, Geologic iations, Arctic, Tundra, Scaling, Gravels, Mud, ls, Shales, Bottom sediments, Cattails, oactivity, Interfaces, Organic matter, oisotopes, Gamma rays, Uranium isotopes, Radium radioisotopes, Potassium radioisotopes, Spectrometers, Erosion, Fallout, Littoral, Algae, Biota, Genetics, Plankton.
Identifiers: Detector, Alaska, Hudeuc Lake, Pullin Lake, Graphite Lake, Old John Lake, Pingo Lake, Twelve Mile Lake, Brant Lake, Imikpuk Lake, North Meadow Lake, Gyttja, Duff, Ooze, Cobbles, Equisetum, Thorium-232, Yukon River, Nebesna River, Moose Creek, Arctic Circle Hot Springs, Radon, Central City (Colo), Mutation, Beta rays, Cosmic radiation, Steese Highway, Point Barrow.

High human whole-body counts of Eskimo population in northern Alaska introduced through fallout particles from nuclear weapons testing prompted study of background radiation in various Alaskan lakes. Measurements of ionizing radiation, made during 1965 in 9 lakes, 3 rivers, 1 hot springs area, and adjacent terrestrial substrates in Alaska, indicated that background radiation in these habitats varied greatly. The lakes were characterized by a small amount of ionizing radiation at mid-depths and increasing quantities near the air and sediment boundaries. Moreover, radioactivity of sediments near shore was 3.2 times greater as that near the center. This pattern of background radiation has been relatively consistent in natural lakes of diverse geographic areas; hence, a model for background radiation in freshwater lakes is proposed. Variations in this model were a function of local differences in geologic substrates and input of allochthonous materials. Radioactivity from sediments in Arctic tundra ponds was due to naturally occurring radionuclides with probable effects on biota. Authors speculate that organisms living in or near sublittoral sediments of lakes in recent times might undergo more frequent genetic changes than plankton or organisms in deepwater sediments. (See Vol. 2, No. 18, Field 5C, W69-07441). (Jones-Wis)
W69-08272

TRANSFER OF Zn-65 and Cr-51 THROUGH AN ESTUARINE FOOD CHAIN,
Bureau of Commercial Fisheries, Beaufort, N. C. Radiobiological Lab.
John P. Baptist, and Curtis W. Lewis.
Symp on Radioecology, Proc 2nd Natl Symp, May 15-17, 1967, Ann Arbor, Mich, Nelson, Daniel J and Evans, Francis C (eds). US Atomic Energy Comm, Doc CONF 670503, pp 420-430. 5 fig, 5 tab, 28 ref, disc. Available from Clearinghouse as CONF 670503 at $3.00 in paper copy and $0.65 in microfiche.

Descriptors: *Zinc radioisotopes, *Chromium, *Radioactivity, *Estuarine environment, *Food chains, Phytoplankton, Brine shrimp, Fish, Trophic level, Sea water, Chlamydomonas, Temperature, Salinity, Gamma rays, Spectrometers, Zooplankton, Gonads.
Identifiers: Mummichog, Micropogon undulatus, Eucinostomus, Half-life, Muscle, Gills, Spleen, Liver, Digestive tract and contents, Artemia, Fundulus heteroclitus, Radionuclide concentrations, Radionuclide uptake, Concentration processes.

Transfer of assimilated and unassimilated zinc-65 (Zn-65) and chromium-51 (Cr-51) was followed under controlled conditions through an experimental food chain, including phytoplankton, brine shrimp, post-larval fish, and mummichog. Food-chain transfer of Zn-65 and Cr-51 studies are needed because these radionuclides are released in relatively large amounts and accumulated by organisms in aquatic environments. Two separate but similar experiments were conducted measuring uptake of Zn-65 and Cr-51 from food; uptake from water was measured in conjunction with one of the two experiments. Both radionuclides were successively transferred through each level to the fourth trophic level, and concentrations generally declined up the food chain. Assimilated concentrations of Zn-65 were higher than those of Cr-51 in all trophic levels. Preliminary experiments indicated that organisms of each trophic level emptied their digestive tracts of radioactive contents within 48 hours when radioactive food was followed by non-radioactive food. Experimental data were used to calculate theoretical maximum concentrations. Comparison of results from the food chain with results of experiments on uptake from seawater indicated that the food chain was generally the more efficient pathway for uptake of Zn-65 and Cr-51 by all trophic levels except the second. (See Vol. 2, No. 18, Field 5C, W69-07441). (Jones-Wis)
W69-08273

THE PHOSPHORUS AND ZINC CYCLES AND PRODUCTIVITY OF A SALT MARSH,
Georgia Univ., Athens. Dept. of Zoology.
L. R. Pomeroy, R. E. Johannes, E. P. Odum, and B. Roffman.
Symp on Radioecology, Proc 2nd Natl Symp, May 15-17, 1967, Ann Arbor, Mich, Nelson, Daniel J and Evans, Francis C (eds). US Atomic Energy Comm, Doc CONF 670503, pp 412-419. 3 fig, 1 tab, 33 ref.

Descriptors: *Zinc radioisotopes, *Phosphorus radioisotopes, *Salt marshes, *Cycling nutrients, Georgia, Sediments, Bacteria, Detritus, Estuaries, Plankton, Ecosystems, Sinks, Tracers, Crabs, Shrimp, Mullets, Fish, Algae.
Identifiers: Duplin River (Ga), Spartina alterniflora, Organisms, Tursiops truncatus, Brevoortia tyrranus, Concentration processes.

By synthesizing results of experiments using phosphorus-32 (P-32) and zinc-65 (Zn-65) with earlier work in Georgia salt marshes, the cycles of the elements P and Zn are described quantitatively. Marsh grass and sediments dominate both cycles. The uppermost meter of sediments contains enough P to support Spartina production for 500 years and enough Zn for 5000 years. Spartina production removes P and Zn from subsurface (reduced) sediments and introduces them into the water (via bacterial utilization and subsequent utilization by detritus feeders) at a rate that replaces total water P in a month and total water Zn in a year. Significant part of P is exported from the marsh in organisms and detritus. The P and Zn in estuarine water are in equilibrium with plankton, bacteria, and surface (oxidized) sediments. Equilibrium strongly favors the sediments. Subsurface-sediment compartment of P and Zn is probably replaced by conversion of oxidized sediments to reduced sediments through creek meandering. Oxidized sediments are in equilibrium with water receiving inputs of P and Zn from land and sea. Transfer of P and Zn from deep sediments to water by Spartina explains the high concentration of these elements in the water. (See Vol. 2, No. 18, Field 5C, W69-07441). (Jones-Wis)
W69-08274

A COMPARISON BETWEEN THE UPTAKE OF RADIOACTIVE AND STABLE ZINC BY A MARINE UNICELLULAR ALGA,
Comitato Nazionale per l'Energia Nucleare, La Spezia (Italy).
M. Bernhard, and A. Zattera.
Symp on Radioecology, Proc 2nd Natl Symp, May 15-17, 1967, Ann Arbor, Mich, Nelson, Daniel J and Evans, Francis C (eds). US Atomic Energy Comm, Doc CONF 670503, pp 389-398. 5 fig, 7 ref, disc. Available from Clearinghouse as CONF 670503 at $3.00 in paper copy and $0.65 in microfiche.

Descriptors: *Zinc radioisotopes, *Marine algae, *Resins, Sea water, Physicochemical properties, Tracers, Distribution, Chelation, Detergents, Radioactivity, Amino acids.
Identifiers: *Radionuclide uptake, *Phaeodactylum tricornutum, EDTA, Ligurian Sea, European Mediterranean.

Organic substances occurring in seawater or introduced as contaminants, e.g., detergents, may chelate zinc and influence its availability to algae. Uptake of zinc-65 (Zn-65) AND STABLE ZINC BY A MARINE UNICELLULAR ALGA (Phaeodactylum tricornutum) and by a chelating

resin (Chelex-100) was studied in batch cultures during a certain time interval. In all experiments, the distribution pattern of Zn-65 and stable zinc between particulate matter (algae or chelating resin) and natural and artificial seawater medium differed. When Zn-65 was added as ionic zinc, proportionately much more radioactive zinc was taken up than stable zinc. However, when Zn-65 is added as Zn-EDTA-complex to a batch containing seawater and Chelex, stable zinc was initially taken up at a higher rate than was Zn-65. These preliminary results do not explain the difference in distribution of radioactive and stable zinc, but the data show that uptake rate of the stable isotope does not necessarily follow uptake rate of the radioactive isotope if the two are present in different physical-chemical states. This possibility must be taken into account in tracer studies and in predictions of the distribution of radioisotopes in environment based on specific isotope content approach. (See Vol. 2, No. 18, Field 5C, W69-07441). (Jones-Wis)
W69-08275

METABOLISM OF ZINC-65 IN EUPHAUSIIDS,
Oregon State Univ., Corvallis; and Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
Scott W. Fowler, Lawrence F. Small, and John Mark Dean.
Symp on Radioecology, Proc 2nd Natl Symp, May 15-17, 1967, Ann Arbor, Mich, Nelson, Daniel J and Evans, Francis C (eds). US Atomic Energy Comm, Doc CONF 670503, pp 399-411. 8 fig, 34 ref, disc. Available from Clearinghouse as CONF 670503 at $3.00 in paper copy and $0.65 in microfiche.

Descriptors: *Zinc radioisotopes, *Marine animals, *Crustaceans, *Metabolism, *Temperature, Radioactivity, Guts, Oxygen, Tracers, Oregon, Gamma rays, Spectrometers, Columbia River, Weight, Surfaces, Cycling nutrients.
Identifiers: *Euphausia pacifica, *Thysanoessa spinifera, Exoskeleton, Eyes, Muscle, Body fluid, Autoradiographs, Detector, Half-life, Radionuclide uptake, Radionuclide concentration, Radionuclide elimination, Concentration processes.

To help understanding of biological role of zinc in marine food-chain organisms, authors studied uptake and retention of zinc-65 (Zn-65) by the pelagic crustaceans Euphausia pacifica and Thysanoessa spinifera. Experiments were performed at three temperatures (5, 10, and 15 deg C) and two concentrations of radiozinc (10 and 25 microcuries/liter). Weight-specific uptake and elimination of Zn-65 by dead (formalin-preserved) animals and by live animals (before molting) were statistically similar over all temperatures and Zn-65 concentrations tested. Molted exoskeletons averaged 41% of total live body activity. Largest fraction of radiozinc was associated with exoskeleton. Second largest fraction was associated with muscle and gut, with a smaller fraction in eyes and body fluid. Autoradiographs showed Zn-65 mainly located on exoskeleton and between muscle fibers, not intra-myofibrillar. Weight-specific activity varied inversely with weight, suggesting surface area phenomenon for uptake and loss. Relationships between Zn-65 uptake and dry weight, and between oxygen consumption and dry weight, varied by an order of magnitude. Authors conclude that Zn-65 uptake from water is neither directly nor indirectly related to euphausiid metabolism, which are potentially important in cycling of radioactivity from 'hot' pools in the sea. (See Vol. 2, No. 18, Field 5C, W69-07441). (Jones-Wis)
W69-08276

THE POTENTIAL IMPORTANCE OF SPARTINA ALTERNIFLORA IN CONVEYING ZINC, MANGANESE, AND IRON INTO ESTUARINE FOOD CHAINS,
Bureau of Commercial Fisheries, Beaufort, N. C. Radiobiological Lab.
Richard B. Williams, and Marianne B. Murdoch.
Symp on Radioecology, Proc 2nd Natl Symp, May 15-17, 1967, Ann Arbor, Mich, Nelson, Daniel J and Evans, Francis C (eds). US Atomic Energy Comm, Doc CONF 670503, pp 431-439. 4 fig, 3 tab, 21 ref, disc. Available from Clearinghouse as CONF 670503 at $3.00 in paper copy and $0.65 in microfiche.

Descriptors: *Zinc radioisotopes, *Manganese, *Ron, *Estuarine environment, *Food chains, Radioactivity, Cycles, Salt marshes, North Carolina, Phytoplankton, Detritus, Radioisotopes, Sediment, Spectrometers, Atlantic Ocean, Standing crop, Productivity, New Jersey, Georgia, Delaware, Plant growth.
Identifiers: *Spartina alterniflora, Beaufort (N C), Sprout stage.

This study was conducted to increase insight into the flow of energy and materials in an estuarine ecosystem. Potential importance of cord grass, Spartina alterniflora, in conveying radioisotopes of zinc, manganese, and iron into estuarine food chains was evaluated on the basis of its annual production, its content of the three elements, and its annual cycle of growth and decay. Growth of Spartina was studied with harvest and other techniques, in salt marshes near Beaufort, North Carolina. Standing crop at maturity (in the fall) and annual production were estimated to average 545 and 650 grams dry weight per square meter, or 208 and 248 grams of carbon per square meter, respectively. Spartina production approached one-third the total phytoplankton net production of adjacent estuaries, and was thus potentially important in estuarine food chains. Zinc, manganese, and iron all had markedly higher concentrations in dead Spartina than in live, and averaged 22, 200, and 5000 parts/million (dry weight), respectively, in dead material. Unusually high iron content of the dead material suggested that Spartina detritus may be especially important in the movement of radioisotopes of iron from water and sediment into estuarine animal populations. (See Vol. 2, No. 18, Field 5C, W69-07441). (Jones-Wis)
W69-08277

ALGAE: AMOUNTS OF DNA AND ORGANIC CARBON IN SINGLE CELLS,
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
For primary bibliographic entry see Field 02K.
W69-08278

LAKE TERMINOLOGY: WATER BLOOM,
Michigan State Univ., East Lansing.
J. O. Veatch, and C. R. Humphrys.
Bull Mich Agric Coll Exp Station, East Lansing, p 241, 1964. 1 fig.

Descriptors: *Eutrophication, Algae, Ducks, Color, Fishkill, Lakes, Odor, Toxicity, Water pollution effects, Water quality, Cattle.
Identifiers: *Definitions, *Water bloom, Toxic algae, Recreational use.

This lexicon of lake terminology defines a water bloom as: 'A prolific growth of plankton. A bloom of algae may be so dense that it imparts a greenish, yellowish, or brownish color to the water. The growth may be so concentrated in some parts of a lake that it interferes with swimming and boating. The algae not only imparts a disagreeable odor, but it may be a cause of fish mortality, and some species may be poisonous to cattle and ducks and a menace to drinking water supplies.' This entry includes an aerial photograph of an algal bloom concentrated in bay of a lake. (Eichhorn-Wis)
W69-08279

NITROGEN FIXATION IN SOME ANOXIC LACUSTRINE ENVIRONMENTS,
Florida Univ., Gainesville. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 02H.
W69-08280

PRACTICAL ALGAE CONTROL METHO FOR NEW HAMPSHIRE WATER SUPPLIES,
New Hampshire Water Supply and Pollution Co trol Commission, Concord.
Terrence P. Frost.
J New Hampshire Water Works Assoc, 7 p, Ap 1960. 6 ref.

Descriptors: *Algae control, *Water supply, *N Hampshire, Algae, Odor, Taste, Light Tempe ture, Nutrients, Copper sulfate, Stratification.
Identifiers: *Corrective treatment, *Preventati treatment, Algae nuisance, Algae bloom, Alg growth, Water density, Convection currents, Alg treatment costs, Dinobryon, Concord (N H), anacook Lake (N H).

Author briefly reviews characteristics of algae a associated problems in New Hampshire water su plies, outlining preventative measures togeth with easiest and most economical controls used date. Symptoms are undesirable taste and odor water supplies, blooms in reservoirs, fouled pip and clogged filters. Occurrence of algae is fluenced by light, temperature, convection c rents, density stratification (spring and fall t novers circulate bottom materials and algae, oft initiating algal bloom), and nutrients wh promote algal growth. Ideally, each waterwo should periodically examine samples microsco cally to monitor algae species and apply preven tive treatment before nuisance levels are reach Algal control in most of New Hampshire's public surface water supplies is practicable and expensive. Penacook Lake, supplying water Concord, has a problem caused primarily by species Dinobryon; this lake could be treated w copper sulfate to a depth of ten feet (3,380 a feet) for $340. Municipalities can obtain help fr New Hampshire's Water Pollution Commission Sanitary Engineering Division for identification organisms and recommended dosages of cop sulfate. Use of chlorination and copper sulf seem the best available means and only accepta chemicals for treating their water suppli (Ketelle-Wis)
W69-08282

THE 'WORKING' OF THE MADISON LAKES
For primary bibliographic entry see Field 02H.
W69-08283

BIOLOGICAL OXIDATION RATES IN MI ACID WATER REGIMES,
Pennsylvania State Univ., University Park. Inst Research on Land and Water Resources.
For primary bibliographic entry see Field 05G.
W69-08379

DISTRIBUTED PARAMETER MODEL THERMAL EFFECTS IN RIVERS,
Rutgers - The State Univ., New Brunswick, N.J.
Robert C. Ahlert, Gabriel Biguria, and M. Schlanger.
1969 ASME/AIChE Stream Pollution Abatem Conference - June 12, 1969 Rutgers Universi - The State of New Jersey, 30 p, 12 fig, 35 OWRR Project A-019-NJ.

Descriptors: *Temperature, *Oxygen dema Cooling water, Biological oxygen demand, Therm pollution, Thermal stratification.

The authors have developed meanes of calcula temperature distributions downstream of a ther outfall. This model is used to calculate the distri tion of temperatures on a stream cross-sect Contributions to the oxygen dynamics of strea are temperature sensitive and vary substantly with respect to the local temperature distribu In this paper, the effects of temperature photosynthesis, reaeration and oxygen dema reactions are generated from a critical revie the literature. In turn, temperature depende have been combined with temperature dist tions to assess the effect of distributed tempera on stream oxygen dynamics. Comparisons

with a uniform temperature model. There is a cant difference between the two models and ssible to conclude that temperature distribu- nust be taken into account in analysis of n quality downstream of thermal outfall. rt-Rutgers)
08394

MAL EFFLUENT MAY CUT COST OF MP COCKTAIL.
ical World, p 30, May 27, 1968. 1 p.

iptors: *Heated water, *Shrimp, *Thermal ion, Supply, Biology, Fish farming.
fiers: Turkey Point Plant, Shrimp farming, i Univ. Inst. of Marine Sciences.

onstant supply of heated water in effluents power plants is being used experimentally for p farming. The project is at Turkey Point in Florida. A survival rate of 90% is predicted seven ponds used (4-one quater acre ponds, acre ponds and one-one acre pond). ntly two quarter acre ponds are stocked with four month old juvenile shrimp which have fed hake, herring, alfalfa, corn, soybean meal squid. In further aquaculture experiments ano will be studied. (Sherman-Vanderbilt)
08401

VARIATION OF WATER TEMPERA- ES DUE TO STEAM ELECTRIC COOLING RATIONS,
erbilt Univ., Nashville, Tenn.
E. Edinger, Derek K. Brady, and Willard L. s.
al of Water Pollution Control Federation, Vol o 9, p 1632-1639, Sept 1968. 8 p, 4 fig, 3 ref.

iptors: *Thermal pollution, *Thermal power Diurnal, Heat, Industry, Temperature, ewater, Cooling water.
ifiers: *Electric power generation.

r temperatures in a body of water receiving heat from a thermal electric generating sta- ary with time due to changing plant loading meteorological conditions. The time-averaged eratures as well as the amplitude of the plant erature variation decrease with distance from ischarge area and approach the water tem- ures that would result from meteorological in- ces alone. As part of a continuing research on enser water discharge, a study of the com- influence of varying plant loading and orological conditions on water temperatures een made to test various time-varying predic- nethods. Derivation of exponential equations and a sample problem are included. (Ross- erbilt)
08405

USE OF RESERVOIRS AND LAKES FOR DISSIPATION OF HEAT,
gical Survey, Washington, D. C. Water rces Div.
rl Harbeck, Jr.
gical Survey Circular 282, U.S. Depart. of terior, Washington, D.C., 1953. 6 p, 2 fig, 3 ref.

iptors: *Evaporation, *Water supply, *Ther- pollution, *Cooling ponds, Climatology, logy, Energy-budget, Air temperature, temperature, Equilibrium, Stratification, ption, Storage, Latent heat, Reservoir.
fiers: Lake Hefner, Southeastern Colorado.

putational method is presented for estimat- e possible saving in water resulting from the lakes or existing reservoirs instead of cooling for the dissipation of excess heat. This is a n areas where water supplies are scarce. For o reservoirs studied, annual water savings, akes instead of cooling towers, were found to - 50 percent. However, these figures do not apply to reservoirs built solely to dissipate excess heat, because the resulting evaporation rate (added surface and added heat) will be greater than the amount of water used in cooling towers. (Sherman-Vanderbilt)
W69-08406

AN INVESTIGATION INTO THE EFFECTS OF WARMED WATER FROM MARCHWOOD POWER STATION INTO SOUTHAMPTON WATER,
Southampton Univ. (England); Southampton Harbour Board (England); and Central Electricity Generating Board, Southampton (England).
John P. M. Pannell, Albert E. Johnson, and John E. G. Raymont.
Proceedings of the Institution of Civil Engineers, pp 35-62, Oct 16, 1962. 28 p, 17 fig, 4 tab, 3 ref.

Descriptors: *Cooling water, Plankton, Salinity, Thermal pollution, Outfall chamber, Tidal cycles, Aquatic environment.
Identifiers: *Warmed water, *Warmed water discharge, Cooling pond, Sea temperature, Limnoria, Teredo, Marchwood Power Station, Southampton water.

The new generating station at Southampton has resulted in a rise of about 50 F. in an area of Southampton water about 1/4 mile radius around the station outfall. The Fawley Refinery has had a similar effect on its own area. The tidal currents move the warm water for considerable distances in a layer below the cold fresh and above the cold salt water, the streams tending to keep to the southern shore of the estuary. The dispersal patterns are extremely complicated. Other than the wind, the maximum portion of the warmed water from Marchwood Generating Station into Southampton water is caused by salinity variations and the physical position of the intake and outfall structures. Thermograph readings at the intake show that equilibrium has not yet been reached, because the temperature of the deeper water is still slowly rising. In similar estuaries with wide salinity variations it can be expected that dispersion of heat will be by mixing and not by cooling to atmosphere. With one exception, re-circulation has not taken place and the Marchwood Basin tends to act as a sump. The breeding period of Limnoria has been extended and the incidence of Teredo appears to have increased. There appears to have been no diminution in the total amount of plankton over the years. (Ross-Vanderbilt)
W69-08408

ENVIRONMENTAL ASPECTS OF THERMAL STATION DESIGN,
Burns and Roe, Inc., Oradell, N. J.
R. T. Richards.
Civil Engineering, pp 45-47, May 1968. 3 p, 3 fig.

Descriptors: *Thermal pollution, *Environmental effects, *Cooling tower, *Thermal power plants, *Power plant, Fisheries, Hydraulic models.
Identifiers: U.S. Army Corps, Dry tower, Wet tower.

Power companies are facing an increaxing problem of finding thermal plant sites acceptable from an environmental standpoint. The siting and design are complicated by a lack of firm and reasonable environmental criteria for determining site suitability. Public authorities need basic scientific information on the long-range effects of adding heat to streams. The interest and money of both private corporations and public agencies is available for this study now that thermal pollution has become recognized as a national problem. Cooling towers are suggested as a solution to the heat loading by these large plants. A conservative public, however, objects to their large size and cost. Another disadvantage is the production of fog. Other solutions are off-stream cooling ponds, dilution and dispersion of the warm water, and combinations of the above methods. (Sherman-Vanderbilt)
W69-08409

THERMAL DISCHARGES,
Michigan Univ., Ann Arbor. School of Public Health.
Ronald H. Laberge.
Water and Sewage Works, p 536-540, Dec 1959. 5 p, 1 tab, 5 fig, 16 ref.

Descriptors: *Thermal pollution, *Thermal loading, Stream aquatic environment, Domestic wastes, Industrial wastes, Toxicity, Oxygen demand, Dissolved oxygen, Self-purification, Reaeration, Saturation.
Identifiers: Aquatic Life Advisory Committee of the Ohio River Valley, Water Sanitation Commission, Trout.

The intention of this paper is to explain the effects of temperature on a stream. Thermal loadings to streams are rapidly becoming a critical problem in regard to maintaining a healthy lotic environment. Fish and aquatic life are discussed with reference to: the optimum, tolerable and critical temperature levels, chemical toxicity and oxygen requirements. The stream temperature is discussed in terms of depth, season and distance from discharge. It is described as an agent in relation to other environmental factors for which some data is given. The effects of temperature self-purification characteristics of a stream are shown by means of a hypothetical river situation. The relation of oxygen, deoxygenation and reaeration are quantitatively developed. A method is presented for computing the allowable thermal loading to meet required minimum dissolved oxygen levels. (Sherman-Vanderbilt)
W69-08413

ESTIMATING FORCED EVAPORATION FROM COOLING PONDS,
Geological Survey, Denver, Colo.
G. Earl Harbeck, Jr.
Journal of the Power Division, Proceedings of the American Society of Civil Engineers, Vol 90, No PO3, pp 1-9, Oct 1964. 10 p, 2 fig, 5 ref.

Descriptors: *Thermal pollution, *Water management, *Power plants, Energy budget, Mass transfer, Meteorological data, Reservoir.
Identifiers: Natural inflow, Energy storage, Water surface, Cooling pond, Bowen ratio, Wind profile.

Based on energy-balance concepts, a graph has been developed to permit the estimation of the increase in evaporation, or forced evaporation, resulting from the addition of heat by a power plant to a cooling pond or reservoir. In order to use the graph, the data needed are the amount of heat added by the plant, the air temperature and the wind speed measured at the nearest weather station. The percentage of heat that is added and that is utilized in measuring evaporation increased with both wind speed and temperature. Simplifying assumptions and approximations have been made. (Sherman-Vanderbilt)
W69-08414

RECIRCULATION OF COOLING WATER IN RIVERS AND CANALS,
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
Gaza L. Bata.
Journal of the Hydraulics Division of the American Society of Civil Engineers, Vol 83, No HY3, p 1265-1 thru p 1265-26, June, 1957. 26 p, 17 fig, 12 ref.

Descriptors: *Design criteria, *Recirculated water, Coolants, Diversion, Flow, Froude number, Stratification, Upstream, Downstream, Rivers, Canals.
Identifiers: Intake, Outlet, Warm wedge, Interface.

The recirculation of water after it has been used as a coolant in thermoelectric plants and returned to the river or canal from which it was originally drawn is of great importance to the economy of operation of such plants. Among the many factors that affect the amount of recirculation, the most important ones are the channel and discharge, the

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distance between intake and outlet of the flow diverted for cooling, the degree of heating of the diverted water, and the relative amount of diversion. three major conclusions concerning the recirculation of cooling water at a stream plant may be drawn: (1) the three zones of flow are not influenced by one another; the critical depths are established at the end sections of the upstream and middle zones; (2) in the three-dimensional case with side intake and outlet, the amount of recirculation is governed in magnitude by the depths immediately upstream and downstream from the side intake; and (3) the amount of recirculation for the two-dimensional case of a bottom-slot intake is much less than that for a side intake. (Sherman-Vanderbilt)
W69-08416

SELECTIVE WITHDRAWAL FROM DENSITY - STRATIFIED RESERVOIRS,
California Inst. of Tech., Pasadena.
Norman H. Brooks, and Robert C. Y. Koh.
Journal of the Hydraulics Division, ASCE Vol 95, No HY4, p 1369-1400, July 1969. 2 p, 12 fig, 28 ref.

Descriptors: *Reservoirs, *Stratified flow, *Withdrawal, Fluid flow, Hydraulics, Outlets, Selectivity, Water quality.
Identifiers: Laboratory tests, Mathematics.

Analyses and experiments for selective withdrawal flows from linearly stratified fluids, including inviscid, viscous, and turbulent cases are presented. A review of discrete layer systems is also included. These thin jet-like flows have been observed both in the laboratory and in large reservoirs, and boundary layer assumptions appear to be justified. For turbulent withdrawal flows away from immediate vicinity of the outlet, it is hypothesized that Koh's viscous diffusive experiments and analysis can be applied by replacing the kinematic viscosity, v, and the molecular diffusivity, D, by the vertical eddy diffusivity, Em. For self-generated turbulence, it is predicted that the proper characteristic length is a= (q/ (sq. rt. of (g (epsilon))) to the 1/2 power, in which q= the unit discharge and (epsilon)= -(1/po) dp/dy. Equations and a graph are given for predicting the thickness of the withdrawal layer under various flow assumptions from real reservoirs. Transients are also presented. The results of this paper may be used in predicting the performance of a multioutlet system in dams for water quality control by selective withdrawal. (Hsieh-Vanderbilt)
W69-08419

CONDITIONS FOR COEXISTENCE OF AQUATIC COMMUNITIES WITH THE EXPANDING NUCLEAR POWER INDUSTRY,
Bureau of Commercial Fisheries, Washington, D. C. Resource Management Branch.
William S. Davis.
Nuclear Safety, Vol 10, No 4, p 292-299, July-August 1969. 8 p, 15 ref.

Descriptors: *Thermal pollution, *Radioactive wastes, *Nuclear power plants, *Aquatic environment, Waste-discharge, Water quality control, Water pollution effects, Heavy metals, Chemical wastes, Absorption, Retention, Distribution, Copper, Bioassay, Diversion.
Identifiers: Contaminated zone, Intrastate, National Technical Advisory Committee.

Communities of aquatic plants and animals cannot indefinitely withstand indiscriminate use of their environment for disposal of the thermal, radioactive, and chemical waste of nuclear and fossil-fueled thermoelectric production. The diversion of large quantities of water for use in cooling condensers may also be harmful. Although developing water-quality standards will limit introduction of such wastes into interstate and coastal waters, they will not regulate specifically the amount of water taken into power plants for cooling. New regions of temperature, radioactivity, and chemistry will be established in many interstate and coastal waters when the limits imposed by water-quality standards and licensing authorities are attained nationwide. The efforts of aquatic biologists and engineers must be complementary to ensure wide use of the water resources of the nation. (Sherman-Vanderbilt)
W69-08420

THE EFFECTS OF THERMAL POLLUTION ON RIVER ICE CONDITIONS,
Army Terrestrial Sciences Center, Hanover, N. J.
S. L. Dingman, W. F. Weeks, and Y. C. Yen.
Water Resource Research, Vol 4, No 2, pp 349-362, Apr 1968. 14 p, 7 fig, 1 tab, 2 ref.

Descriptors: *Thermal pollution, *Ice, *Rivers, *Navigation, Differential equation, Hydrometric variables, Meteorologic variables, Energy budget.
Identifiers: *Ice-free reaches, St. Lawrence Seaway, Mississippi River, Minneapolis - St. Paul (Minn).

An attempt is made to calculate the length of the ice-free reach that develops during the winter below a thermal pollution site on a river. A differential equation for the steady-state heat balance of a volume element of a river is developed. The computer program makes possible more universally applicable estimations. The differential equation for the steady-state heat balance of a volume element of a river leads to the expression x= Cx times the integral from Two to Twx of dTw over Q*, where x is distance downstream from the pollution site to the cross section where the water temperature equals Twx, Two is water temperature at x equals zero, Q* is rate of heat loss from the water surface, and Cx is a constant that includes flow velocity and depth. The value of x at Twx equals 0 deg C is taken as the length of the ice-free reach. Q* is the sum of heat losses due to evaporation, convection, long- and short-wave radiation, and other processes, each of which is evaluated by an empirical or theoretical expression. The two principal limitations in accurately calculating downstream temperature changes are related to difficulties in evaluating the degree of lateral mixing in natural rivers and the convective and evaporative heat losses under unstable atmospheric conditions. Observations of lengths of ice-free reaches on the Mississippi River are in good agreement with the calculated values. Significant portions of the St. Lawrence Seaway can be kept ice-free by the installation of nuclear reactors at appropriate locations. (Shin-Vanderbilt)
W69-08422

DETERMINATION OF FEEDING CHRONOLOGY IN FISHES,
Marquette Univ., Milwaukee, Wis. Dept of Biology.
Rezneat M. Darnell, and Richard R. Meierotto.
Transactions of the American Fisheries Society, Vol 91, No 3, p 313-320, July 1962. 2 fig, 4 tab, 20 ref.

Descriptors: *Bullheads, *Fish food organisms, *Food habits, *Methodology, Crustaceans, Detritus, Insects.
Identifiers: *Digestive rates, *Ictalurus melas, Hyalella azteca, Stomach analyses.

A method is presented for determining the 24-hour chronology of feeding intensity of fishes, based on periodic stomach sampling and digestive rate studies involving a standard food item, Hyalella azteca. The method is applied to a natural population of young black bullheads. Based on 3-hour collection intervals, two feeding peaks were found: a major peak occurring just before dawn and a secondary peak occurring shortly before dark. Data on food habits, expressed as percentage of total volume are: amphipods 54.1, insect larvae 19.2, organic detritus 15.1, insect adults 4.5, algae and fungi 3.4, juvenile crayfish 2.8. Tabular data include results of stomach analyses and calculated food volumes for 3-hour collection periods. (Voigtlander-Wis)
W69-08514

FOOD HABITS OF THE YELLOW BASS, M CUS MISSISSIPPIENSIS, CLEAR LAKE, IO SUMMER 1962,
Iowa Cooperative Fisheries Research Unit, Am
Rudy Kraus.
Iowa Acad of Sci, Vol 70, pp 209-215, 1963.
2 tab, 6 ref.

Descriptors: *Fish food organisms, *Food ha *Iowa, *Yellow bass, Amphipoda, Crustacean sects, Zooplankton, Eutrophication.
Identifiers: *Clear Lake, *Diurnal period Iowa, Entomostraca, Immature insects, Odona

Yellow bass are a dominant member of the fauna of eutrophic Clear Lake. Stomach ana of fish collected by gill netting indicated that y yellow bass fed on the following (percen frequency of occurrence): Copepoda Cladocera 50.7, Chronomidae 30.7, Hyalella In terms of bulk (volume, estimated but not sured) food organisms appeared in the same of importance. Similar analysis of stomach older yellow bass yielded: immature insects Cladocera 43, Hyalella 12, and Copepoda frequency of occurrence. Adult insects and fish were of incidental importance. Among im ture insects, Diptera, mostly chironomids, most important (71%). Comparison with prev studies (two, four and five years earlier) indi increasing importance of immature insects, cially chironomid larvae, and decreasing portance of crustacean zooplankton. Yellow showed a diurnal feeding periodicity, with p observed at 6 p.m. and 8 a.m. Fish activity, ferred from gill-net catches indicated greates tivity between 6 p.m. and 4 a.m. (Voigtlander-
W69-08515

EXPERIMENTS ON THE DISSOLVED OXY REQUIREMENTS OF COLD-WATER FISHI
Oregon State Univ., Corvallis. Pacific Coope Water Pollution and Fisheries Research Labs.
Robert C. Davison, Wilbur P. Breese, Charles Warren, and Peter Doudoroff.
Sewage and Industrial Wastes, Vol 31, No 950-966, August 1959. 2 fig, 4 tab, 17 ref.

Descriptors: *Cold water fish, *Dissolved ox *Oxygen requirements, Laboratory Tests, Sal Sculpins, Sulfite liquors.
Identifiers: *Coho salmon, Feeding studies, O hynchus kisutch, Cottus perplexus.

Dissolved oxygen requirements of juvenile salmon and sculpin were determined under e mental conditions of flowing water and cont temperature. Experiments performed in showed no appreciable changes in minimu ygen concentrations (1.1–2.1 milligrams tolerated for one day between 12-20 deg (tolerance was reduced as upper thermal lim approached (25 deg C). In summer and fall, a stant temperature (20 deg C), salmon tolerat one day oxygen concentrations below 2 grams/liter but succumbed at 1 milligram Feeding experiments at 18 deg C and oxyge centrations of 2, 2.9, and 9 milligrams/lit dicated a weight loss due to sluggishness an feeding at 2 milligrams/liter oxygen, and ga weight of 28 and 42% at 2.9 and 9 milligram respectively. Addition of 1200 milligram sulfite liquor had no appreciable effect on requirements, but authors state results are n clusive. Tests on sculpin indicate no differe oxygen requirements, but capacity for acclim tion may be less. Figures include diagram of paratus. Tabular data include results of varia ygen concentrations, feeding studies and liquor tests. (Voigtlander-Wis)
W69-08516

EUTROPHICATION,
J. Foehrenbach.
Journal WPCF, Vol 41, No 6, pp 1029-103
1969. 53 ref.

riptors: *Eutrophication, *Reviews, Documentation, Bibliographies, Phosphorus compounds, Nitrogen compounds, Bioindicators, uctivity, Waste treatment, Water pollution ef-, Water pollution sources, Cycling nutrients, comparisons, Economics, Algae, Algal con-Algicides, Sediments, Dissolved oxygen, Ox-demand, Cyanophyta, Diatoms, Sampling, Michigan.
tifiers: Cultural eutrophication, Species diver-Chemical precipitation.

or reviews 53 studies contributed to the phication literature during the period 1966-. Subject coverage, with number of literature ons per subject in parentheses, are: use of fer-d water to increase biological production (8); ification of nutrients (6); oxygen kinetics (3); control (2); sources of nitrogen and phorus (4); role of sediments (2); results of an cultural activities (2); effects of pollutional (2); cyanophyte blooms and decrease in algal ies diversity (2); eutrophication indicators in Michigan (2); sampling and diatom-indica-(2); nutrients, their critical levels and cycling advanced waste treatment techniques with estimates (7); chemical treatment for nutrient val with cost estimates (7). (Eichhorn-Wis)
-08518

LUENCE OF RATE OF FEEDING ON BODY POSITION AND PROTEIN METABOLISM BLUEGILL SUNFISH,
ana Univ., Bloomington. Dept. of Zoology.
by D. Gerking.
iological Zoology, Vol XXVIII, No 4, p 267-October 1955. 3 fig, 5 tab, 46 ref, disc.

criptors: *Feeding rates, *Sunfishes, Efficien-Nitrogen, Metabolism.
tifiers: *Bluegill, *Lepomis macrochirus, otein utilization, Nitrogen consumption, zation efficiencies.

of the most important aspects of fish produc-is the relationship between a population and its supply, and the details of utilization of that supply. Bluegills were fed mealworms nebrio) at five rates, equal to 1.5, 2, 3, and 4 s the metabolic rate, equalling from 1 to 3.5% ne original (beginning) body-weights per day. d items and fish were analyzed for protein and protein nitrogen, fat and ash. Efficiency of ein absorption was not affected by different ing rates (range 95.8-97.0%). Chemical com-tion of fish was affected by feeding rate with substance (oven-dry weight), with fat content easing while ash and total nitrogen diminished eeding rates increased. Percentage increases the entire range of feeding rates for dry ght, fat and total nitrogen were: dry weight, 9.8-; fat, 140-383; total nitrogen, 0.0-38.4. ogen retention increased with feeding rate, and iency of protein utilization increased asymp-ally with feeding rate. Tabular data include yses of chemical composition of food and fish, nates of ash, fat, and total nitrogen content of and analyses of nitrogen consumption and re-on. (Voightlander-Wis)
-08520

EFFECT OF TEMPERATURE, SEDIMENT, FEEDING ON THE BEHAVIOR OF FOUR IONUCLIDES IN A MARINE BENTHIC PHIPOD,
on State Univ., Corvallis. Dept. of Oceanog-y.
A. Cross, John M. Dean, and Charles L. rberg.
lable from Clearinghouse for Sci and Tech In-ation as CONF-670503. Symp on Radioecolo-roc 2nd Natl Symp, May 15-17, 1967, Ann Ar-Mich. Nelson, Daniel J and Evans, Francis C). US Atomic Energy Comm, Doc CONF -03, pp 450-461. 4 fig, 4 tab, 48 ref, disc.

Descriptors: *Radioisotopes, *Amphipoda, *Benthic fauna, *Marine animals, *Temperature, *Sediments, Cycles, Zinc radioisotopes, Oregon, Sea water, Radioactivity, Gamma rays, Spectrometers, Tagging, Brine shrimp, Trophic level, Feeding rates, Washington.
Identifiers: *Radionuclide uptake, Anonyx, Cerium-144, Chromium-51, Scandium-46, Biological half-life, Species, Hanford Atomic Operation, Washington, Effective half-life, Molting, Exoskeleton.

Laboratory studies were conducted to determine effects of temperature, feeding, and presence of sediments on behavior of zinc-65 (Zn-65) in a gammarid amphipod (Anonyx sp) captured off the Oregon coast. In feeding experiments, cerium-144, (Ce-144), scandium-46 (Sc-46), and chromium-51 (Cr-51) were used in addition to Zn-65. Accumulation and elimination rates of Zn-65 were temperature dependent, although the effect appeared minimal within this organism's seasonal temperature range. Individual differences in Zn-65 accumulation rates for amphipods of similar size had a mean standard deviation range of 14-19%. Elimination rates of Zn-65 were increased in presence of sediment and were significantly greater in feeding than in nonfeeding amphipods. Anonyx, which fed on adult Artemia labeled simultaneously with Zn-65, Ce-144, Sc-46, and Cr-51, retained 55% of the Zn-65 and less than 10% of the Ce-144 and Sc-46. Transfer of Cr-51 was not measurable. Zn-65 loss during molting depended upon whether the zinc had been accumulated from food or water. When uptake was from water, approximately 20% of the Zn-65 body burden was lost with the cast exoskeleton, whereas only 2.0% was lost when Zn-65 was accumulated from food. The potential role of Anonyx in radioactivity cycling in marine environments is discussed. (See also Vol. 2, No. 18, Field 5C, W69-07441). (Jones-Wis)
W69-08522

ELIMINATION OF IODINE, COBALT, IRON, AND ZINC BY MARINE ZOOPLANKTON,
North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
Edward J. Kuenzler.
Available from Clearinghouse for Sci and Tech Information as CONF-670503. Symp on Radioecology, Proc 2nd Natl Symp, May 15-17, 1967, Ann Arbor, Mich. Nelson, Daniel J and Evans, Francis C (eds). US Atomic Energy Comm, Doc CONF 670503, p 462-473. 2 fig, 6 tab, 21 ref, disc.

Descriptors: *Marine animals, *Zooplankton, *Iodine radioisotopes, *Cobalt radioisotopes, *Iron, *Zinc radioisotopes, Fallout, Nuclear explosions, Tracers, Copepods, Ecology, Radioactivity, Pacific Ocean, Indian Ocean, Atlantic Ocean, Sea water, Temperature, Resins, Ion exchange, Gamma rays.
Identifiers: *Elimination rates, Pyrosoma verticillatum, Cyclosalpa pinnata, Sagitta enflata, Sagitta hexaptera, Euphausiids, Pteropods, Chaetognaths, Heteropod, Neocalanus gracilis, Pleuromanna xiphias, Pleuromamma abominalis, Candacia ethiopica, Euchirella, Euchaeta marina, Salpa cylindrica, Salpa fusiformis, Thysanopoda tricuspidata, Crab megalops, Cavolinia inflexa, Euclio pyramidata, Cuvierina columnella, Carinaria lamarcki, Scaeurgus unicirrhus, Beroe ovata, Scaler, Scintillation crystal, Analyzer, Comparative physiology, Biogeochemistry.

Measurement of elemental elimination rates were made using zooplankton labeled by fallout from nuclear test and with tracers. Rates depended on element, species, and time since labeling. In experiments performed soon after labeling, copepods had elimination rates of 1-6%/hour for iodine (I), 4-6%/hour for cobalt (Co), and about 1%/hour for zinc (Zn), Pyrosoma, about 1%/hour for I and Zn, and 2-3%/hour for Co and iron (Fe); salpidae, 8-19%/hour for Co; Sagitta, 22%/hour for I, 11%/hour for Co, and 3%/hour for Zn; euphausiids, 1%/hour for I and Co, and 5%/hour for Zn; pteropods, 5-6%/hour for I and Fe, and 1-3%/hour for Co and Zn. Filtration and ion-exchange techniques indicated the physical and chemical form of eliminated products: most iodine was probably anionic but copepods eliminated some cationic; much iron was particulate; significant amounts were soluble anionic or non-exchangeable; some cobalt was particulate; most was cationic, zinc was frequently particulate, but also exchangeable and non-exchangeable. (See also Vol. 2, No. 18, Field 5C, W69-07441). (Jones-Wis)
W69-08523

SORPTION OF RADIOACTIVE NUCLIDES BY SARGASSUM FLUITANS AND S NATANS,
Texas A and M Univ., College Station; and Kansas Univ., Lawrence.
John E. Simek, J. A. Davis, C. E. Day III, and Ernest E. Angino.
Available from Clearinghouse for Sci and Tech Information as CONF-670503. Symp on Radioecology, Proc 2nd Natl Symp, May 15-17, 1967, Ann Arbor, Mich. Nelson, Daniel J and Evans, Francis C (eds). US Atomic Energy Comm, Doc CONF 670503, p 505-508. 2 fig, 5 ref. disc.

Descriptors: *Radioisotopes, *Algae, *Sorption, Absorption, Gulf of Mexico, Atlantic Ocean, Radioactivity, Gamma rays, Potassium radioisotopes, Manganese, Cesium, Radium radioisotopes, Uranium radioisotopes.
Identifiers: *Sargassum fluitans, *Sargassum natans, Seaweed, Zirconium-95-niobium-95, Prebomb material, Ruthenium-106-rhodium-106, Ruthenium-103-rhodium-103, Cerium-144-praseodymium-144.

Sargassum natans and S fluitans, free-floating marine algae, can effectively concentrate certain radionuclides. In the evaluation of radionuclides found associated with these two species, an answer was sought as to the manner of this association. Floating samples were collected from the Gulf of Mexico and from North Atlantic areas. An analysis of Sargassum material collected prior to 1940 (prebomb) provided a positive means of comparing the activity added to the spectrum by nuclear activity. Tests utilizing acid, base, and neutral washes, were devised to determine whether adsorption or absorption was the major nuclide-plant association. Washington with uncontaminated, doubly distilled water, resulted in removal of only small amounts of potassium-40 (K-40), probably due simply to a washing out of sea salts. Separate, short term (up to 1 hour) washed of samples with slightly acidic and basic solution failed to indicate any activity other than that of K-40. However, acid and base washes for 24 hours produced definite evidence of activity; over this period, breakdown of the plant material became obvious. Results suggest that radionuclides in question are absorbed, or metabolically fixed, rather than adsorbed to Sargassum natans and S fluitans. (See also Vol. 2, No. 18, Field 5C, W69-07441). (Jones-Wis)
W69-08524

THE NATURE OF THE DISTRIBUTION OF TRACE ELEMENTS IN LONGNOSE ANCHOVY (ANCHOA LAMPROTAENIA HILDEBRAND), ATLANTIC THREAD HERRING (OPISTHONEMA OGLINUM LaSUEUR), AND ALGA (UDOTEA FLABELLUM LAMOUROUX),
Puerto Rico Nuclear Center, Mayaguez.
Robert Y. Ting, and V. Roman de Vega.
Available from Clearinghouse for Sci and Tech Information as CONF-670503. Symp on Radioecology, Proc 2nd Natl Symp, May 15-17, 1967, Ann Arbor, Mich. Nelson, Daniel J and Evans, Francis C (eds). US Atomic Energy Comm, Doc CONF 670503, p 527-534. 5 fig, 15 ref, disc.

Descriptors: *Algae, *Herrings, Copper, Iron, Cobalt, Manganese, Atlantic Ocean, Puerto Rico, Spectroscopy, Distribution, Calcium, Trophic levels, Food webs.
Identifiers: *Trace elements, *Anchoa lamprotaenia, *Opisthonema oglimun, Udotea flabellum, Zinc, Nickel, Puerto Rico, La Parguera, Joyuda.

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Qualitative and quantitative information on stable elements contained in organisms and their environment is essential in predicting distribution patterns of artificially introduced radioisotopes of the same elements. Little is known of the distribution and variability of various elements and their radioisotopes within species of marine organisms sampled from the same area at a given time. To study their transfer through food webs and to evaluate concentration factors at each level, trace amounts of the elements copper, iron, and zinc, were determined in longnose anchovy (Anchoa lamprotaenia Hildebrand) and in alga (Udotea flabellum Lamouroux) from La Parguera and Joyuda, Puerto Rico. Levels of cobalt, copper, iron, manganese, nickel, and zinc in Atlantic thread herring (Opisthonema oglinum LaSueur) from La Parguera, were also determined. Analyses were accomplished with atomic absorption spectroscopy. Concentrations of the elements in individuals of the same species sampled within the same locality at the same time did not approximate normal distribution; however, distributions of the log-transformed concentrations closely approximated a normal curve in most cases. With expanded nuclear technology, radioisotopes in the environment may approach levels for which knowledge of the distribution patterns of these materials will be of primary importance. (See also Vol. 2, No. 18, Field 5C, W69-07441). (Jones-Wis)
W69-08525

PHOSPHORUS TURNOVER BY CORAL REEF ANIMALS,
Georgia Univ., Athens. Dept. of Zoology; and North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
L. R. Pomeroy, and E. J. Kuenzler.
Available from Clearinghouse for Sci and Tech Information as CONF-670503. Symp on Radioecology, Proc 2nd Natl Symp, May 15-17, 1967, Ann Arbor, Mich, Nelson, Daniel J and Evans, Francis C (eds). US Atomic Energy Comm, Doc CONF 670503, pp 474-482. 1 fig, 3 tab, 34 ref, disc.

Descriptors: *Phosphorus, *Coral, *Reefs, *Marine animals, Fish, Ecosystems, Cycling nutrients, Temperature, Light quality, Chlorophyll, Zooplankton, Algae, Polychaeta, Crustacea, Mollusca, Echinodermata, Pacific Ocean.
Identifiers: Eniwetok Atoll, Turnover time, Tridacna crocea, Woods Hole Oceanographic Institution, Acropora hyacinthus, Pocillopora eydouxi, Porites lobata, Leptastrea purpurea, Fungia fungites, Zooxanthellae, Acanthurus triostegus, Conus ebraeus.

Coral reefs are particularly interesting ecosystems in which to study nutrient cycling, because of their great diversity of life and their high rates of organic production in a nutrient-depleted environment. Phosphorus (P) content and elimination rates were measured for dominant reef animals at Eniwetok Atoll, and flux of P through the organisms was expressed as turnover time. Herbivorous fishes appear to receive in their diet just enough P for growth and reproduction; this is reflected in a somewhat lower excretion rate and longer turnover time than would be predicted for organisms of their size, particularly the juveniles. Carnivorous animals and deposit feeders receive excess P in their diet, and their turnover time does not differ from ecosystems with a more abundant P supply. Of 5 species of reef corals examined, 4 showed a very long turnover time and little flux of P to the environment. Tridacna crocea showed a typical turnover time for a mollusc of its size, but seemed to lose most P via incorporation in living zooxanthellae, which are subsequently lost. This sampling of the flux of P is necessarily incomplete although organisms known to be dominant have been selected for study. (See also Vol. 2, No. 18, Field 5C, W69-07441). (Jones-Wis)
W69-08526

ACCUMULATION OF FALLOUT RADIOISOTOPES BY BIVALVE MOLLUSCS FROM THE LOWER TRENT AND NEUSE RIVERS,
Bureau of Commercial Fisheries, Beaufort, N. C. Radiobiological Lab.
Douglas A. Wolfe, and Claire L. Schelske.
Available from Clearinghouse for Sci and Tech Information as CONF-670503. Symp on Radioecology, Proc 2nd Natl Symp, May 15-17, 1967, Ann Arbor, Mich, Nelson, Daniel J and Evans, Francis C (eds). US Atomic Energy Comm, Doc CONF 670503, p 493-504. 5 fig, 2 tab, 24 ref, disc.

Descriptors: *Fallout, *Radioisotopes, *Mollusks, *North Carolina, Gamma rays, Radioactivity, Spectrometers, Salinity, Cesium, Manganese, Zinc radioisotopes, Nuclear explosions, Cycling nutrients, Strontium radioisotopes, Aquatic populations, Estuarine environment, Sea water, Trace elements, Fresh water, Rainfall, Potassium radioisotopes, Cobalt radioisotopes, Radium radioisotopes.
Identifiers: *Trent River, *Neuse River (N C), Elliptio complanatus, Rangia cuneata, Polymesoda caroliniana, Ruthenium-106, Ruthenium-103, Cerium-144, Cerium-141, Zirconium-95-niobium-95, Barium-140-lanthanum-140, Chinese nuclear tests, Half-life, Biological concentrators, Anodonta cataracta, Anodonta imbecillis, Lampsilis cariosa, Congeria leucophaeta, Macoma phenax, Radionuclide accumulation, Biogeochemistry.

Bivalve molluscs are useful indicators of distribution of fallout radioisotopes in an aquatic environment. Three species of filter-feeding molluscs, Elliptio complanatus, Rangia cuneata, and Polymesoda caroliniana, were collected from stations in the Trent and Neuse Rivers in Eastern North Carolina at intervals for more than a year. Soft tissues of each species were ashed and analyzed for gamma radioactivity with a multichannel spectrometer (4 x 4-inch sodium iodide crystal). Concentrations of gamma-emitting fallout radioisotopes were monitored in Rangia over a 30-mile stretch of river and a salinity range from less than 0.1 to greater than 15 parts per thousand. Ruthenium-106, cerium-144, cesium-137, manganese-54, and zinc-65 were present in all samples. After Chinese nuclear tests in May and December 1966, the amounts of cerium-141, ruthenium-103, zirconium-95, niobium-95, and barium-140-lanthanum-140 rose suddenly in the samples. Ruthenium-106 and ruthenium-103 were more concentrated in Rangia from downstream stations (salinity range 6-15 parts per thousand), whereas cesium-137 was more abundant in the same species from fresher water (salinity range 0-8 parts per thousand). Zirconium-95-niobium-95 from the Chinese test in May remained in Rangia from freshwater stations after it was no longer detectable in the same species collected downstream. (See also Vol. 2, No. 18, Field 5C, W69-07441). (Jones-Wis)
W69-08527

TRACE ELEMENT COMPOSITION OF INSHORE AND OFFSHORE BENTHIC POPULATIONS,
Puerto Rico Nuclear Center, Mayaguez. Marine Biology Program.
D. K. Phelps, R. J. Santiago, D. Luciano, and N. Irizarry.
Available from Clearinghouse for Sci and Tech Information as CONF-670503. Symp on Radioecology, Proc 2nd Natl Symp, May 15-17, 1967, Ann Arbor, Mich, Nelson, Daniel J and Evans, Francis C (eds). US Atomic Energy Comm, Doc CONF 670503, p 509-526. 7 fig, 2 tab, 25 ref, appendix.

Descriptors: *Benthic fauna, *Sea water, Iron, Sediments, Copper, Ecology, Silts, Sands, Clays, Temperature, Depth, Food webs, Fish, Clams, Radioisotopes, Puerto Rico, Salinity, Gravels, Reefs, Stable isotopes, Trophic level, Digestion, Cycling nutrients, New England, Industries, Interfaces, Hydrogen ion concentration, Crustaceans.
Identifiers: *Inshore fauna, *Offshore fauna, *Trace elements, Zinc, Scandium, Samarium, Taxonomic position, Scallops, Substrate, Anasco River, Puerto Rico, Polychaetes, Nemerte
Agloaphamus, Axiopsis, Capit
Paraprionospio, Biogeochemistry, Fish f
Urophycis tenuis, Urophycis chuss, Terrebe
Cirratuid, Sipunculid, Capitellid, Paraprionos
Armandia, Magelonid, Orbiniid, Agloapha
Nemertea, Pilargiid, Glycerid, Ninoe, Amphipo

Preliminary studies of stable element partitio
within shallow water assemblages of infauna
shown discrimination between iron (Fe) and
(Zn) that follows feeding categories. Select de
feeders concentrate Fe over ambient sedimen
levels, while non-select deposit feeders and
nivores concentrate Zn. This study repres
further investigation of relationships between
tribution of Fe, Zn, copper (Cu), scandium (
and samarium (Sm) and the ecology of benthi
semblages. Levels of Cu and Sm in fauna
enhanced by proximity to land mass. Iron an
were higher in fauna collected from silty clays
in fauna living in sands and gravelly sands, wit
apparent increase due to influence of land m
Zinc levels in animals showed no relationshi
proximity of land mass or to changes in subst
although higher values tended to occur in or
isms found in offshore silts and clays. Relations
between content of stable elements and fee
types were substantiated. The physical and ch
cal state of the elements were related to
availability to feeding types. Organisms' conte
stable elements were apparently not influence
their taxonomic positions, environmental temp
tures, or depth in which they occur. (See also
2, No. 18, Field 5C, W69-07441). (Jones-Wis)
W69-08528

**ELIMINATION AND TRANSPORT OF COB
BY MARINE ZOOPLANKTON,**
North Carolina Univ., Chapel Hill. Dept. of
vironmental Sciences and Engineering.
Edward J. Kuenzler.
Available from Clearinghouse for Sci and Tec
formation as CONF-670503. Symp on Radioec
gy, Proc 2nd Natl Symp, May 15-17, 1967, Ann
bor, Mich. Nelson, Daniel J and Evans, Franc
(eds). US Atomic Energy Comm, Doc C
670503, p 483-492. 1 fig, 3 tab, 25 ref, disc.

Descriptors: *Zooplankton, *Marine ani
*Cobalt, *Cycling nutrients, Sea water, T
mocline, Pacific Ocean, Diffusion, Eco
Physiology, Migration, Radioactivity, Tra
Resins, Cobalt radioisotopes, Biomass, Fish,
exchange, Phytoplankton, Nekton, Geochem
Copepods, Crustaceans.
Identifiers: *Radionuclide elimina
*Radionuclide transport, Turnover time, W
Hole Oceanographic Institution, Neocal
gracilis, Pleuromamma xiphias, Pleuromamm
dominalis, Pyrosoma verticillatum, Siphonoph
Salpa cylindrica, Doliolids, Cheatognatha, Sa
elegans, Sagitta enflata, Euchaeta m
Thysanopoda tricuspidata, Ostracods, Euphau
Medusae, Pteropods, Cavolinia inflexa,
pyramidata, Styliola subula, Cuvierina columi
Crab megalops, Ctenophore, Cephalap
Scaeurgus unicirrhus, Microflagellates.

Zooplankton are significant agents in cyclir
cobalt in sea surface layers and in its tran
through the termocline. Net hauls in eastern P
Ocean in spring 1962 showed that, over the w
day, mean biomass (wet weight) in the upper
meters was 3.87 grams/100 cubic meters, of w
42% were copepods, 13% pyrosomas,
siphonophores, 11% salps and doliolids, and
were chaetognaths. Diurnally migrating zoopl
ton amounted to 4.16 grams/square meter, co
ing of 22% copepods, 19% pyrosomas,
siphonophores, 18% salps and doliolids,
medusae, and 4% chaetognaths. Using data
literature on cobalt content of zooplankton, o
water and measured values of zooplankton
elimination rates, turnover time for cobalt i
upper 100 meters was calculated to be abo
years. Similarly, diurnally migrating zoopla
carry down and eliminate below the thermoc

tity of cobalt equal to that in the upper 100
rs, in about 56 years. Transport of cobalt
igh the termocline by migrating zooplankton
often equal or exceed transport by vertical
diffusion. (See also Vol. 2, No. 18, Field 5C,
-07441). (Jones-Wis)
-08529

DIOISOTOPE MEASUREMENTS OF THE CERA OF PACIFIC SALMON,
gon State Univ., Corvallis. Dept. of Oceanog-
y.
nan F. Kujala, I. Lauren Larsen, and Charles
sterberg.
lable from Clearinghouse for Sci and Tech In-
ation as CONF-670503. Symp on Radioecolo-
roc 2nd Natl Symp, May 15-17, 1967, Ann Ar-
Mich, Nelson, Daniel J and Evans, Francis C
). US Atomic Energy Comm, Doc CONF
503, p 440-449. 6 fig, 4 tab, 21 ref.

criptors: *Radioisotopes, *Salmon, *Pacific
an, Gamma rays, Zinc radioisotopes, Man-
se, Potassium radioisotopes, Cesium, Colum-
River, Fresh water, Alaska, Fish, Trophic level,
itoring, California, Fallout, Ecology, Spec-
eters, Radioactivity, Tagging, Migration, Age,
s, Plankton, Herrings, Mussels, Clams,
ers, Gonads.
tifiers: *Viscera, Concentration, Plume, Half-
Alaska, Bristol Bay, Asiatic stock, Interna-
al problem, Cook Inlet, Petersburg, Canada,
na River, Johnstone Strait, Barkley Sound, St
de Fuca, Oregon, Astoria, Depoe Bay,
fornia, Eureka, Point Hope, Clupea pallasii,
hausiids, Engraulis mordax, Cancer magister,
stodes, Tapeworms (Parasites), Japanese
eries Agency, Aleutian Island, Liver, Stomach,
ric caeca, Gills.

fic salmon, Oncorhynchus spp, concentrate
ain gamma-emitting radionuclides--zinc-65
-65, manganese-54 (Mn-54), potassium-40,
cesium-137 (Cs-137)--in their viscera. In some
s, pattern of radionuclide concentration seems
ted to position of the Columbia River fresh-
r plume, a well-known source of Zn-65 in the
heast Pacific Ocean. Fishes whose migration
s were far south of the river had more Zn-65,
less Mn-54. Salmon in southeastern Alaskan
rs displayed a distinct difference in relative
ndance of Zn-65 and Mn-54. Manganese-54
dominant isotope in salmon of northern Alskan
rs and Zn-65 was more prominent in fish from
adian and contingent United States waters. The
mbia River plume undoubtedly accounted for
ease in Zn-65. Concentrations of radionuclides
r with species and stocks. Chinook and coho,
h feed more on small fishes than the sockeye,
mulated the highest concentrations of Zn-65,
54, and Cs-137. Sockeye, feeding on a lower
hic level, had low radioactivity, with Mn-54 the
inant radionuclide, some Zn-65, and no Cs-
Chum and pink salmon most nearly resembled
sockeye in radioactivity. Ocean food habits and
ratory pathways both appear relevant to levels
rtificially produced gamma-emitters in salmon
era. (See also Vol. 2, No. 18, Field 05C, W69-
41). (Jones-Wis)
9-08530

C-65 IN ECHINODERMS AND SEDIMENTS THE MARINE ENVIRONMENT OFF EGON,
gon State Univ., Corvallis. Dept. of Oceanog-
y.
rew G. Carey, Jr.
ilable from Clearinghouse for Sci and Tech In-
nation as CONF-670503. Symp on Radioecolo-
Proc 2nd Natl Symp, May 15-17, 1967, Ann Ar-
Mich, Nelson, Daniel J and Evans, Francis C
). US Atomic Energy Comm, Doc CONF
503, p 380-388. 4 fig, 3 tab, 12 ref, disc.

criptors: *Zinc radioisotopes, *Sediments,
arine animals, *Oregon, *Environment, Colum-
River, Radioisotopes, Gamma rays, Spectrome-
ters, Benthic fauna, Depth, Distance, Ecology, Discharge (Water), Washington, Ecosystems, Bathymetry, Continental shelf, Continental slope, Sampling, Radioactivity, Detritus, Iron, Surface waters, Plankton, Nekton.
Identifiers: *Echinoderms, Hanford (Wash), Ocean bottom, British Columbia, Cascadia Abyssal Plain, Detector, Parastichopus californicus, Luidia foliolata, Pseudarchaster dissonus, Lophaster furcilliger, Zoroasteridae, Thrissacanthias penicillatus, Hymenaster, Heterozonias alternatus, Solaster borealis, Nearchaster aciculosus, Asteroids, Ophiura sarsii, Brisastér latifrons, Allocentrotus fragilis, Ctenodiscus crispatus, Paelopatides, River plume.

Role of benthic invertebrate organisms in determining fate of certain radionuclides in oceanic bottom has been studied. Artificial radionuclides, induced in water used as coolant in the Hanford reactors, are discharged into the Pacific Ocean by the Columbia River. Radionuclides from atmospheric atomic testing have also been detected in the environment. Gamma-ray spectrometric measurements show that levels of zinc-65 (Zn-65) decrease in both sediments and benthic animals with distance from the river mouth and with water depth. Although Zn-65 decreases rapidly in animals below 400 meters, it was detected to 2900 meter depths in animals, but not in sediments. Levels of Zn-65 in benthic animals appear to be associated with depth, distance from the point source, position of the Columbia River plume in the surface waters, and ecology of organisms. Bottom fauna is considered important in determining distribution of induced radionuclides. Some animals filter bottom water for food, while others ingest large quantities of sediment with associated organic materials. Marine organisms constantly remove certain elements from their environment, concentrating them in their tissues. There are intraspecific and interspecific variations in concentrations of Zn-65 in bottom organisms. (See also Vol. 2, No. 18, Field 5C, W69-07441). (Jones-Wis)
W69-08531

WARM-WATER IRRIGATION: AN ANSWER TO THERMAL POLLUTION,
Eugene Water and Electric Board, Oreg.
Luther J. Carter.
Science, Vol 165, No 3892, p 478-480, Aug 1969. 3 p.

Descriptors: *Waste water disposal, *Irrigation, *Heated water, *Thermal powerplants, Nuclear powerplants, Irrigation water, Water temperature, Waste water (Pollution), Cooling water.
Identifiers: Warm water irrigation.

The use of warm water for irrigation as a means of disposing of nuclear powerplant effluents is being studied in 2 projects in Oregon. The effects of warm water is controlling frost, lengthening the growing season, and stimulating plant growth are being evaluated. Water supply pipes buried in soil will supply both soil heat and irrigation water. Preliminary results suggest improvement in strawberry, string bean, and corn yield, but no differences in alfalfa, soybeans, and lima beans. (Knapp-USGS)
W69-08561

BACTERIOLOGICAL WATER QUALITY OF SEVERAL RECREATIONAL AREAS IN THE ROSS BARNETT RESERVOIR,
Southeast Water Lab., Athens, Ga.; and Mississippi Air and Pollution Control Board, Jackson.
For primary bibliographic entry see Field 05B.
W69-08563

THERMAL DISCHARGES REQUIRE ADVANCE PLANNING,
Battelle-Northwest, Richland, Wash. Water Resources Systems Section.
R. T. Jaske.
Ind Water Eng, Vol 6, No 7, pp 18-21, July 1969. 4 p, 3 fig, 5 ref.

Descriptors: *Thermal powerplants, *Thermal pollution, Networks, Heated water, Systems analysis, Model studies, Path of pollutants, Water pollution effects, Pollution abatement, Planning.
Identifiers: Thermal discharge planning.

Careful planning of nuclear powerplant locations and methods of handling of thermal discharges is necessary to prevent harmful thermal pollution. In general, the impact area of 1,000 MW production is about 5 1/2 sq mi. This corresponds to river lengths of about 10 mi on large, slow-moving streams, and much longer lengths on smaller and faster rivers. Mixing zones may be thermal barriers to fish movement. Although thorough mixing lengthens the impact area, minimizing the initial temperature differential is of greater value than maximizing heat loss rates by using high differential temperatures. The presence of dams changes the thermal regime, but the effect must be studied on the basis of individual cases. It is possible to regulate thermal regime by dams so as to permit construction of more powerplants than the unregulated stream could support, but this is practical only on large streams. The use of cooling towers allows greater freedom of plant location. Model studies may be used to calculate effects of plant distribution, networks, cooling, regulation, and economic factors. (Knapp-USGS)
W69-08564

BIOLOGICAL CONCENTRATION OF PESTICIDES BY ALGAE,
North Texas State Univ., Denton. Dept. of Biology.
B. Dwain Vance, and Waymon Drummond.
J Amer Water Works Ass, Vol 61, No 7, p 360-362, July 1969. 3 p, 2 tab, 11 ref. Grant No CC00269 (PHS).

Descriptors: *Pesticide residues, *Algae, Bioassay, Bioindicators, Fishkill, Hazards, Pesticide kinetics, Pesticide toxicity, Pollutants, Water pollution effects, Aldrin, Dieldrin, Endrin, DDT.
Identifiers: Pesticide bioaccumulation.

Algae, the base constituents of the aquatic food chain, concentrate pesticides and are much more resistant to toxic effects than the higher organisms that eat them. Algal cultures were grown in the presence of DDT, aldrin, dieldrin, and endrin, in concentrations of 5-20 microgram per ml. The algae concentrated the pesticides 100 times or more in all the tests. The data are tabulated. Practically no degradation of the pesticides occurred. (Knapp-USGS)
W69-08565

A SYSTEMS ANALYSIS OF AQUATIC THERMAL POLLUTION AND ITS IMPLICATIONS: VOLUMES 1, SUMMARY REPORT,
Travelers Research Corp., Hartford, Conn.
Philip B. Cheney, Frank A. Smith, Robert O. Brush, Douglas J. Pelton, and James D. Kangos.
Travelers Res Corp Rep No 7743-341a, Jan 1969. 30 p, 1 fig, 1 tab.

Descriptors: *Thermal pollution, *Water pollution effects, *Thermal powerplants, Costs, Economics, Legal aspects, Social aspects, Productivity, Regulation, Legislation, Governments, Systems analysis, Biological properties.
Identifiers: Thermal powerplant effluents.

A systems analysis study of thermal discharges was made to learn the broad thermal, environmental, and economic effects of releasing heated effluents to surface waters. Summaries are presented of steam-electric technology, waste heat production, heat disposal methods, effects on water bodies of waste heat, ecological effects of waste heat, social considerations, and costs of a number of possible regulations of heat disposal. (Knapp-USGS)
W69-08599

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LABORATORY INVESTIGATION OF THE EFFECTS OF THERMAL ADDITIONS ON MARINE ORGANISMS CHARACTERISTIC OF CAPE COD CANAL,
Sandy Hook Marine Lab., Highlands, N. J.
J. B. Pearce, M. Silverman, and R. Le Goff.
Sandy Hook Marine Lab Final Rep, Mar 1968. 21 p, 5 fig, 5 tab, 19 ref.

Descriptors: *Thermal pollution, *Water pollution effects, *Biological communities, Thermal powerplants, Water temperature, Fishkill, Fishing, Fish management, Cold-water fishing, Sport fishing, Commercial fishing.
Identifiers: *Cape Cod Canal (Mass).

Studies were made to predict the effects of thermal pollution on commercial fish and shellfish in Cape Cod Canal, Massachusetts. Suggestions are made for profitable uses of the heated waters. Tank and flume experiments showed that water temperatures approaching 77 deg F affect many of the fish and invertebrates in the canal. Winter flounder, one of the important sport fishes, are killed by 77 deg water. Other fish are somewhat more tolerant of high water temperatures. (Knapp-USGS)
W69-08611

5D. Waste Treatment Processes

A REVIEW OF THE LITERATURE OF 1968 ON WASTEWATER AND WATER POLLUTION CONTROL.
Federal Water Pollution Control Administration, Washington, D. C. Research Committee.

J Water Pollut Contr Federation, Vol 41, No 6, pp 873-1251, June 1969. 378 p, 3,011 ref.

Descriptors: *Reviews, *Bibliographies, *Chemical analysis, *Water analysis, *Water chemistry, *Waste treatment, *Water quality, Analytical techniques, Industrial wastes, Municipal wastes, Detergents, Biodegradation, Water pollution, Estuaries, Eutrophication, Radioactive wastes, Systems analysis, Thermal pollution.
Identifiers: Pollution control literature review.

A review covers 1968 literature on analytical methods (analysis of anions, cations, and gases; and instrumentation), biological filters, activated sludge, detergents, anaerobic processes, sludge treatment, disinfection, water reclamation and reuse, storm flow, facility evaluation, kinetic models, physical and chemical wastewater treatment, effects of pollution on aquatic life, eutrophication, thermal pollution, microbiology, oxygen sag, groundwater, marine and estuarine pollution, economics of treatment, standards, and industrial wastes (paper, fermentation, meat, dairy, canning, coal, tannery, steel, petroleum, plating, chemical, and radioactive). (Knapp-USGS)
W69-08199

RATIONALE OF STANDARDS FOR USE OF RECLAIMED WATER,
California State Dept. of Public Health, Berkeley. Bureau of Sanitary Engineering.
Herbert B. Foster, Jr., and William F. Jopling.
ASCE Proc, J Sanit Eng Div, Vol 95, No SA3, Pap 6609, pp 503-514, June 1969. 12 p, append.

Descriptors: *Water reuse, *Reclaimed water, *Standards, *Water quality, *California, Waste water treatment, Tertiary treatment, Sewage treatment, Legislation, Regulation.
Identifiers: Reclaimed water standards (Calif).

California has established standards for reclaimed wastewater used for crop and landscape irrigation and recreational impoundments. Insofar as possible the standards avoid the use of specific quality parameters in order to minimize monitoring requirements which would be burdensome to small operations. The major exception is that, where a disinfected reclaimed waste water is necessary, daily coliform bacteria analyses are required. This requirement was one of 4 major controversial points which are presented. Other major points raised in the development of standards are specification of operational controls and practices in the production and use of reclaimed waste water, and quality requirements for the various uses. (Knapp-USGS)
W69-08215

TREATMENT OF HIGH NITRATE WATERS,
Federal Water Pollution Control Administration, Fresno, Calif. San Joaquin Project; and Stanford Univ., Calif. Dept. of Environmental Engineering.
Percy P. St. Amant, and Perry L. McCarty.
Amer Water Works Ass 89th Annu Conf, May 21, 1969, San Diego, Calif, 1969. 18 p, 2 fig, 3 tab, 5 ref.

Descriptors: *Waste water treatment, *Denitrification, *Anaerobic conditions, Anaerobic bacteria, Filtration, Porous media, Aeration.
Identifiers: Anaerobic filtration treatment.

Biological denitrification was investigated as an economically feasible way to remove nitrates from waters to control discharge of nutrients into bodies of water. Pilot-plant studies conducted to estimate chemical requirements, to evaluate anaerobic filter media, and to determine the operating parameters of the anaerobic filtration process. Biological denitrification in anaerobic filters is a reliable process for removing excess nitrates from water supplies. An organic electron donor must be added to accomplish dentrification and methanol has been found to be a satisfactory and inexpensive material for this purpose. Use of one-inch gravel filter media and a detention time of one hour is sufficient for 90% or greater removal of approximately 20 mg/l of nitrate-nitrogen in water with temperature of 12 deg C and above. Costs, operating characteristics, and filter design data are tabulated. (Knapp-USGS)
W69-08228

RETURN FLOWS: A REUSABLE WATER RESOURCE,
Texas Water Development Board, Austin.
John J. Vandertulip.
Water Reuse, Amer Inst Chem Eng Progr Symp, Ser No 78, Vol 63, pp 106-109, 1967. 4 p, 1 tab.

Descriptors: *Water reuse, *Reclaimed water, *Return flow, *Water sources, *Recirculated water, *Water quality, Water quality control, Water pollution control, Sewage treatment, Water quality Act, Industrial wastes, Municipal wastes, Water treatment, Water law, Water management (Applied).
Identifiers: Return flow reuse.

Return flows from various types of water uses constitute an important water resource to be evaluated in water planning. Benefits of increased quantities of available water may be offset by quality deterrents of pollutants. Industrial reuse of water by treatment or recirculation may offer a favorable economic solution to increased water requirements. Water resources planning, water quality management, and interagency coordination are essential factors in a regional approach to development of water resources and the effective integration of return into regional development analysis and water administration. (Knapp-USGS)
W69-08259

REUSE CAN BE CHEAPER THAN DISPOSAL,
Louis Koenig-Research, San Antonio, Tex.; and Texas Univ., Austin.
Louis Koenig, and Davis Ford.
Water Reuse, Amer Inst Chem Eng Progr Symp, Ser No 78, Vol 63, pp 143-147, 1967. 5 p, 3 fig, 2 tab, 14 ref.

Descriptors: *Water reuse, *Water costs, *Decision making, *Reclaimed water, *Waste water disposal, Costs, Injection wells, Water spreading, Sewage treatment, Tertiary treatment, Pipelines, Economics, Desalination, Distillation.
Identifiers: *Water reuse processing costs.

When disposing of waste water causes loss of va ble products, value of water supplies is high fluents are strictly regulated, pollution drain are excessive, or if effluent quality must be hi than the quality of available raw water, it is che to reuse water than dispose of it. Cost curves s that if new water costs $5 per thousand gal. combined cost of disposal and water purchase ways more than the cost of any type of r processing on any waste waters. Costs of disp treatment, conveyance, and reuse processing tabulated and shown graphically to permit c parison of costs of alternatives. The informati the result of a parametric cost study of process to determine costs, sensitivity of final c to the parameters, and estimate the usual valu the parameters. For example, it can be determ that any reuse process is cheaper than dispos mined cavities, but disposal by spreading is che than any reuse. Thermal evaporation or deio tion from 2,500 ppm is more expensive than disposal, but these processes are cheaper tha jection or transport of 50 mi if wastes are we than 1,500 ppm. Treatment for reuse by coag tion, filtration, and sedimentation, or stan secondary sewage treatment, is cheaper than in tion or transport over about 5 mi. (Knapp-USG
W69-08260

WATER REUSE IN SPACE,
General Electric Co., Philadelphia, Pa.
Fred P. Rudek.
Water Reuse, Amer Inst Chem Eng Progr Sy Ser No 78, Vol 63, pp 210-217, 1967. 8 p, 6 f tab, 16 ref.

Descriptors: *Water reuse, *Recirculated wa *Reclaimed water, Electrodialysis, Reverse os sis, Membrane processes, Filtration, Ion excha Water sources, Potable water.
Identifiers: *Spacecraft wastes, Pyrolysis.

Water recovery systems for spacecraft must be able, light, compact, and produce water tha aesthetically unobjectionable. The emphasi date has been to develop simple, once-thro systems that offer foolproof process characteris That is, if they are operational they are most li operating correctly. The liquid to vapor p change processes seem to most readily satisfy requirement. They do so, however, at the exp of system weight, complexity, power requirem etc. The challenge to develop a true long- water recovery system lies in the elimination of and post-treatment chemicals, mechanically c plex ddevices, and excessive electrical p requirements. To date the system offering greatest potential for minimizing expendables electrical requirements appears to be radioisotope-powered vacuum distillation-v pyrolysis unit. This system has been operated f consecutive days, providing potable water urine and wash water. No pre- or post-treat chemicals or filters were required. The 1,200 c pyrolysis temperature insures a bacteria-free v thereby eliminating a potentially serious prot This unit appears to offer the greatest capabili extended life and scale-up for larger crews sinc tle or no electrical power increase would b ticipated. At present the life limitation lies i ability to maintain the catalyst surface in the a state. To data, 30 days of continuous operatio a prototype water recovery system have achieved. We are still a long way from the 45 system required for the manned planetary missions. (Knapp-USGS)
W69-08261

POTENTIAL REUSE OF EFFLUENT AS A TOR IN SEWERAGE DESIGN,
Texas Technological Coll., Lubbock.
George A. Whetstone.
Water Reuse, Amer Inst Chem Eng Progr Sy Ser No 78, Vol 63, pp 255-257, 1967. 3 p, 35

criptors: *Sewage treatment, *Water reuse, rtiary treatment, *Design criteria, Design flow, ers, Waste water disposal, Reclaimed water, ts.
ntifiers: Sewage system design, Sewage system s.

ditionally, overloaded sewers have been paral- d or replaced. Modern sewage treatment plants, able of producing high-quality effluent by ance-free processes on small plots of land, per- a more satisfactory solution. Now, a plant may placed within convenient distance of the point ncipient overload, and the effluent may be em- ed for a beneficial consumptive use near the tment plant. Thus existing sewers remain quate, or new sewers may be planned with less vision for unknowable future loads. (Knapp-GS)
9-08262

MPLETE WATER REUSE,
rence K. Cecil.
ter Reuse, Amer Inst Chem Eng Progr Symp, No 78, Vol 63, pp 258-261, 1967. 4 p, 16 ref.

criptors: *Water reuse, *Sewage treatment, rtiary treatment, Municipal wastes, Reclaimed er, Activated sludge, Filtration, Ion exchange.
ntifiers: Municipal water reclamation.

ter reuse, tertiary treatment, and pollution con- systems and literature are reviewed. A total tment scheme for water reuse and prevention utrient addition to natural waters is presented. onsists of solids removal, activated sludge treat- nt for phosphorus, nitrate and BOD removal, mical precipitation, ion exchange, and steriliza- . About 95% of the input water is recovered. wastes are returned to the watershed. (Knapp-GS)
9-08263

TER REUSE IN MONTERREY, MEXICO,
ulosa y Derivados S.A., Monterrey (Mexico).
propiedad Grupo Quimico.
ctor J. Gomez.
rnal Water Pollution Control Federation, Vol No 4, pp 540-545, 1968. 6 p, 1 fig.

scriptors: *Water reuse, *Municipal wastes, ter chemistry, Boiler feed water, Water quality trol, Cooling water, Industrial water, Water rtage, Water utilization efficiency, Water con- vation, Reclaimed water, Waste water treat- nt, Cost comparisons, Economy.
ntifiers: Monterrey (Mexico).

dity, an extended drought, industrial develop- nt and the population explosion necessitated ter reuse as early as 1955. Some industries treat reuse water individually, while others use the tral treatment facility of a cooperative. Water lity treatment varies with use demands. Uses for watering gardens, cleaning of buildings and ipment, fire protection, cooling, boiler feed, various industrial processes. Production costs well as physical and chemical properties of the ter presented for each quality use type. (Sher- oke-Ariz)
9-08289

STEWATER REUSE AT THE GRAND NYON,
zona State Dept. of Health, Phoenix.
mund C. Garthe, and Wilfred C. Gilbert.
Water Pollut Contr Fed, Vol 40, No 9, pp 1582-35, 1968. 4 p.

scriptors: *Water reuse, *Arizona, Arid lands, oundwater movement, Water rates, Water rces, Water conservation, Water utilization effi- ncy, Activated sludge, Chlorination, Reclaimed ter, Treatment facilities, Cost comparisons, ter costs.
ntifiers: *Grand Canyon.

This paper traces water problems and wastewater reuse at the south rim of the Grand Canyon from the late 1800's to the present. Reclamation efforts began in 1924 with construction of an activated sludge plant supplemented by an anthracite coal filter and chlorination. Treated water was used for toilets, boiler feed water, cooling water and irrigation. Treatment cost of $0.59/1,000 gal. compared favorably to railroad transported water at $3.09/1,000 gal. Additional water was pumped up from Indian Gardens in 1934. Detailed records of cost have been kept by the National Park Service since 1951. Presently, construction of a pipeline from Roaring Springs, on the more water rich north rim, presents the possibilities of abandoning the water reuse system, constructing newer facilities, or continuing the 40-year old plant. Whatever the future, the plant at Grand Canyon has demonstrated that wastewater reuse is an economically sound concept. (Sherbrooke-Ariz)
W69-08290

RENOVATION OF WASTE WATER THROUGH APPLICATION TO AGRICULTURAL CROPLAND AND FORESTLAND,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
Louis T. Kardos, and Earl A. Myers.
Institute for Research on Land and Water Resources, Research Project Technical Completion Report, University Park, Pa., June 1969. 6 p, 3 append. OWRR B-001-PA.

Descriptors: *Sewage effluents, *Wastewater, *Surface runoff, *Subsurface runoff, *Nitrates, Infiltration, Percolation, Soil water, Nitrites, Ammonium compounds, Maganese, Iron, Nitrification.
Identifiers: *Soil aeration, *Oxygen diffusion rate, *Suction lysimeter, Piezometer head, Artesian.

Hydrologic studies on two soil sites indicate that soil permeability can be a highly critical control of hydraulic acceptance of sewage effluent waste water applied to a sloping disposal area. Variations in vertical permeability of the soil resulted in perched water tables and artesian phenomena, with interflow appearing downslope as surface runoff. Total surface runoff ranged from 0 percent of the waste water application during periods of high evapotranspiration to 100 percent on frozen, ice-coated soil. The cycling of effluent application at weekly intervals permitted the soil to remain aerobic as measured by oxygen diffusion rates and gaseous oxygen concentration in the soil profile to a depth of 24 inches. The aerobic condition was reflected in the presence of nitrate as the dominant form of nitrogen in the soil water samples obtained from suction lysimeters at the 6-and 24-inch depth. Nitrite concentrations were generally less than 0.05 mg per liter, and manganese and iron concentrations in the effluent-treated area were not significantly different from those found in the control area. (Pollard-Penn State University)
W69-08377

SURVIVAL AND ACTIVITY OF SEWAGE MICROORGANISMS IN ACID MINE WATER,
West Virginia Univ., Morgantown.
Raymond C. Kralovic, and H. A. Wilson.
Water Research Institute Research Report 1, 1969. OWRR Project A-002-WVA.

Descriptors: *Acid mine water, *Sewage, *Yeasts, *Microorganisms, Microbiology, Biochemical oxygen demand, Hydrogen ion concentration.
Identifiers: *Acid-tolerant bacteria, Oxygen utilization.

Numbers and types of bacteria decrease if the pH of sewage is lowered by addition of acid mine water. A rapid decrease occurs at 4 C and 22 C microbial numbers increase after the initial decrease. The biochemical oxygen demand (BOD) of sewage and acid-mine-water mixtures decreases as the pH of the mixture decreases. At pH 3.5, there is a lag period before much biochemical oxidation occurs. Oxygen utilization is greater if yeasts are inoculated into a sterile sewage and acid-mine-water mixture than when bacteria are used. If together, utilization is greater than for either alone. Qualitative and quantitative microbial estimations were made on Monongahela River water which contains domestic raw sewage and acid mine water. Yeasts were the dominant organisms if the plating medium was at pH 4.0, and bacteria were dominant if the medium was about pH 7.0. The actually acid-tolerant bacteria that will grow in sewage and acid-mine-water mixtures at pH 4.0 probably represent only a few genera. Four such isolates were identified as Bacillus species. Other isolates were identified as Micrococcus candidus and Kurthia variabilis. (Wilson-W Va)
W69-08400

AN INVESTIGATION OF POTENTIAL INTERACTIONS OF COAL AND COAL PRODUCTS FOR USE IN THE TREATMENT OF MINE DRAINAGE WATERS,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
Harold L. Lovell, and James L. Sloughfy.
Institute for Research on Land and Water Resources, Research Project, Technical Completion Report, University Park, Pa, June 1969. 176 p, 1 append, 23 tab, 23 fig. OWRR B-004-PA.

Descriptors: *Mine drainage water, *Acidity, *Neutralization, Coal, Treatment, Activated carbon, Ion, Water quality, Alkalinity, Ion exchange, Absorption, Temperature, Settling rates.
Identifiers: *Coal products, *Steam activation, Mineral matter, Sulphuric acid, Steam activation, Surface area, Reaction rates.

The potential for using coal or coal-products (including commercial activated carbon) for treating mine water was considered. Certain coals whose inherent mineral matter have the capacity to reduce acidity are being employed industrially. Acidity reduction by the organic phases of coal is nil. Coal products heated to 450 degree C in a nitrogen or steam atmosphere have a little acid-reduction response. Coal activated by steam at 800 degree C develops increased specific surfaces, including complex carbon oxides which have the ability to reduce acidity. The properties of such products and commercial activated carbons may have potential in treating these and other polluted waters. (Pollard-Penn State Univ)
W69-08466

MATHEMATICAL MODEL FOR DISSOLVED OXYGEN,
Public Health Service, Philadelphia, Pa. Delaware Estuary Comprehensive Study.
Robert V. Thomann.
Proc, Amer Soc Civil Eng, Vol 89, No SA5, p 1-30, Oct 1963. 30 p, 3 fig.

Descriptors: *Mathematical models, *Dissolved oxygen, *Optimization, *Waste treatment, *Systems analysis, Time series analysis, Sewage effluents, Streams, Digital computers, Analog computers.

A mathematical model was presented for describing time variations of dissolved oxygen (DO) in a finite number of sections in a body of water for optimal sewage treatment. The model, as presented in its general form, embodies all types of inputs and was capable of assessing the effects of any one time varying input in one section of the water body on the DO in any other section. Systems analysis techniques were employed and the DO response equations resulting from the imposition of general input forcing functions were derived. An analytical relationship was developed between the time variation of the sewage effluent in one section and the DO response in any other section. The dependent variable could assume the role of any water quality constituent. Although the systems techniques were general, the analytical model was presented for the case of an estuary without any analytical difficulties. Non-tidal streams were a special case of the general formulation. The model was capable of

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being solved by digital or analog computers. (Thiuri-Cornell)
W69-08532

OPERATIONS RESEARCH ACTIVITIES AT CINCINNATI WATER RESEARCH LABORATORY,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Cincinnati Water Research Lab.
Robert Smith.
Proc, Nat Symp Anal Water Resource Syst, p 241-260, Denver, July 1968. 20 p, 14 fig, 5 ref.

Descriptors: *Water resources, *Operations research, *Waste water treatment, *Mathematical models, *Planning, Design, Optimization, Control systems, Time, Stream improvement, Activated sludge.
Identifiers: Cincinnati Water Research Laboratory, Quasi steady state.

Operations research activities at the Cincinnati Water Research Laboratory were discussed. Operations research activities at CWRL were directed towards the development of mathematical models to represent the performance and cost of all practicable wastewater treatment processes, and the use of the information obtained for the advancement of planning, design and control of wastewater treatment. Two principal types of mathematical models were studied; the quasi steady state model and the time dependent model. The quasi steady state model was based on 24 hours composite measurements and was intended for planning and design of wastewater treatment systems to accomplish a specific treatment task at minimum cost. The time dependent model was used for the study of the practicability of various schemes for controlling processes which receive highly variable intermittent loads. It was concluded that by means of process control the variability of the effluent stream quality and the average performance of the process can be improved.
W69-08534

A TEST OF THE HYPOTHESIS THAT POLLUTION CONTROL IS WORTH WHAT IT COSTS,
Delaware Univ., Newark. Urban Affairs Div.
Robert F. Minnehan.
Proc, Water Resources Seminar 1967-1968, pp 19-52, Univ Del, Newark, Dec 1968. 34 p, 1 tab, 4 fig.

Descriptors: *Mathematical models, *Water quality control, *Pollution abatement, *Optimization, *Cost-benefit analysis, Waste water treatment, Economics, Biochemical oxygen demand, Water resources, Delaware River.
Identifiers: San Francisco Bay.

A benefit-cost mathematical model was developed for water quality evaluation in order to determine whether water pollution control is always worth what it costs and what is the optimal degree of waste reduction. The model's equations were then fitted with coefficients that approximated benefits and costs, with Delaware River Estuary and San Francisco Bay as examples. The results indicated that a high level of treatment is not justified when the total waste load is small in relationship to the assimilative capacity of the stream or adjacent watercourse. The results also indicated that although complete BOD removal is required to maximize net benefits in a heavily polluted river, the costs of waste treatment may exceed the benefits and the control program may not be justified economically. An evaluation of optimal treatment level revealed that the benefit cost ratio was an increasing and a decreasing function of BOD removal. With growth in the quantity of waste flow there may be a point in time where the benefits of pollution abatement will always be less than costs and optimal treatment increased as the quantity of waste flow increased. (Thiuri-Cornell)
W69-08542

TREATING WASTES IN A WATER-SHORT AREA,
Texas Technological Coll., Lubbock.
H. E. Clay.
Textile Chemist and Colorist, Vol 1, No 7, p 176/28-179/32, March 26, 1969. Based on a symposium, February 26-28, 1969, sponsored by A.A.T.C.C. and US Departments of Commerce and Interior.

Descriptors: *Water shortage, *Activated sludge, Biochemical oxygen demand, Chemical oxygen demand, Waste treatment, Aerobic treatment.
Identifiers: *Anaerobic contact process, Textile wastes.

The approach to, and results of, a laboratory study, designed to provide information on the treatability of concentrated wastes produced by textile mills operating in water short areas, are given. Because of high costs of water and scarcity of water in such areas, mill effluents contain very high concentrations of pollutants. Data on the characteristics of raw waste, operating results for activated sludge plant, and operating results for anaerobic contact process are discussed. It was concluded that highly concentrated textile wastes could be effectively treated by both aerobic and anaerobic processes with BOD reductions of 90%. The anaerobic control process is believed potentially better suited. (Livengood-NC State Univ)
W69-08551

WHAT THE MILLS ARE DOING TO CONTROL WATER POLLUTION,
B. V. Hill, J. L. Brown, Jr., A. L. Smith, T. A. Alspaugh, and J. C. Pangle, Jr.
Based on a symposium, February 26-28, 1969, sponsored by A.A.T.C.C. and US Department of Commerce and Interior. Textile Chemist and Colorist, Vol 1, No 6, p 146/25-156/35, March 12, 1969.

Descriptors: *Settling basins, *Biochemical oxygen demand, *Aeration, *Trickling filters, *Lagoons, *Activated sludge, *Anaerobic digestion, *Aerobic, Treatment, *Treatment facilities, Sodium sulfate, Domestic wastes, Equalizing reservoirs, Chemical wastes, Biological treatment, Chemical precipitation, Flocculation.
Identifiers: *Recovery (Waste), Zinc sulphate, Dyeing wastes, Bleaching wastes, Dow surfpac filter, Clarifier.

This article discusses what has been done by seven textile companies to solve the pollution problem. American Enka has constructed three settling basins, an anhydrous sodium sulfate recovery plant, an extended aeration system, and a system for the removal of zinc sulfate from waste water. Detailed descriptions are given. The majority of Burlington Industries' plants employ a modified activated sludge system to treat their wastes. Cannon Mills' treatment plant employs primary settling basins, equalization tanks, aeration for dye wastes, caustic storage tanks for pH control and a two-stage trickling filter. A detailed description of Chatham Mfg. Co.s' aerated lagoon is given. A description of Cone Mills' biological treatment plant which employs high rate filtration, activated sludge and aerobic lagooning alone and in variation is given. Dan River Mills' employs an aerobic lagoon, an aerobic-anaerobic lagoon, a clarifier, an activated sludge basin, a Dow Surfpac filter, and a chemical precipitation unit. A description of M. Lowenstein and Sons' pumping station, screening facility, and basins are given. (Goodwin-NC State Univ)
W69-08556

RESEARCH ON TREATMENT OF DYE WASTES,
Virginia Polytechnic Inst., Blacksburg, Va.
D. L. Michelsen.
Based on a symposium, February 26-18, 1969, sponsored by A.A.T.C.C. and US Departments of Commerce and Interior. Textile Chemists and Colorist, Vol 1, No 7, p 179/32-181/35, March 26, 1969.

Descriptors: *Aeration, *Foam fractiona
*Coagulation, *Biological treatment, Biocher
oxygen demand, Chemical oxygen demand.
Identifiers: *Disperse dyes, *Dyeing wastes.

Recent research projects at Virginia Polytec
Institute on the treatment of disperse dye w
are described and results given. Studies discu
were: (1) the effect of aerated biological treat
of the chemical coagulation demand to e
removal of color from disperse dye wastes
foam fractionation. The results of these studie
not encouraging as these treatments of dispers
wastes have been only partially successful. (L
good-NC State Univ)
W69-08558

MUNICIPAL SEWAGE EFFLUENT FOR RIGATION.
Louisiana Polytechnic Inst., Ruston. Dep
Agricultural Engineering.

Symp on Munic Sewage Effluent for Irrig, Jul
1968, Louisiana Polytech Instit, Ruston, 1968.
p, 4 fig, 16 tab, 260 ref, 1 append. Wilson, C.
Beckett, F. E., Editors.

Descriptors: *Water reuse, *Municipal wa
*Water sources, *Irrigation water, Public he
Economics, Soil investigations, Legal aspects,
response, Water pollution sources.
Identifiers: Municipal waste water reuse, Irriga

A symposium was held to discuss the use of
nicipal sewage effluents for irrigation. L
amounts of relatively pure water are discha
from sewage plants in the United States. Mo
this water finds its way into streams. Wastew
may be viewed as a wasted resource or as a p
tion problem. It is a valuable resource in th
could be used to irrigate a large acreage of lan
is a problem in that it usually contains an appr
ble concentration of plant nutrients which
cause an excessive amount of algae to grow i
body of water into which it is discharged.
nicipal sewage effluent is used for irrigation
few places in the United States. Most of thes
located in the western part of the country. Pa
covering health, economics, soil effects, water
lution effects, legal considerations, and
response are among those included. A brief
mary of the discussion generated by each pap
given. (Knapp-USGS)
W69-08615

SOIL RESPONSE TO SEWAGE EFFLUENT RIGATION,
Robert S. Kerr Water Research Center, Ada, O
R. E. Thomas, and James P. Law, Jr.
Symp on Munic Sewage Effluent for Irrig, Jul
1968, Louisiana Polytech Inst, Ruston, p
1968. 11 p, 41 ref.

Descriptors: *Water reuse, *Artificial rech
*Irrigation water, Soil disposal fields, Soil che
try, Water quality, Water chemistry, Waste w
disposal, Sewage treatment, Nutrients, Water
lution control, Soil water movement.
Identifiers: Wastewater - soil relations
Eutrophication prevention.

Recent emphasis on water pollution control
stimulated research on the application of w
waters to the land. About 2/3 of the more
1,300 systems in operation were designed for t
ment of a wastewater rather than irrigatio
economic crops. A variety of needs and emp
solutions have resulted in the evolution of se
system designs. Each of these designs has
vantages for particular operating conditions.
wastewaters are unsuitable for irrigation bec
toxic or excessive concentrations of pollutant
added during the use cycle. Many industrial
most domestic wastewaters are suitable for i
tion use under good management practices. W
water can cause beneficial or detrimental cha
in physical and chemical properties of soil.
good management practices and system de

eneficial effects are greater than the detrimen-ffects. Wastewaters receive treatment as they ılate through the soil. Systems can be designed operated to accentuate this treatment. The ting soil percolate is immediately suitable for reuse purposes. (Knapp-USGS)
-08616

P RESPONSE TO SEWAGE EFFLUENT,
sylvania State Univ., University Park. Dept. of Technology.
s T. Kardos.
o on Munic Sewage Effluent for Irrig, July 30, , Louisiana Polytech Inst, Ruston, p 21-27, . 7 p, 5 tab, 13 ref.

riptors: *Soil disposal fields, *Water reuse, gation water, Soil-water-plant relationships, chemistry, Water quality, Water chemistry, e water disposal, Sewage treatment, Nutrients, r pollution control, Soil water movement.
ifiers: Wastewater-soil relationships, ophication prevention.

ge effluents are highly enriched with plant ents, and usually are beneficial to agronomic s when used as irrigation water. Experiments conducted irrigating crops on Hublersburg-rstown soils with surface textures ranging silt loam to silty clay loam with slopes from 3- Waste water was applied at 0.25-0.64 inches r to totals of 0,1, and 2 inches per week. The izer equivalent of the nutrients in the water 2000 lb. of 7-12-11 per ac in 1963, 2000 lb. of 5-14 in 1964, 2000 lb. of 5-10-5 in 1965, and lb. of 9-9-16 in 1966. Crop yields are tabu-. Harvest of corn removed nutrients valent to 202% of applied N, 39% of applied P, 62% of applied K. Most of the applied P was in the soil. The soil-water-plant system effi-ly prevented nutrients from reaching surface rs or the water table. (Knapp-USGS)
-08617

T BUILD-UP FROM SEWAGE EFFLUENT IGATION,
State Univ., Logan. Dept. of Irrigation.
Peterson.
o on Munic Sewage Effluent for Irrig, July 30, , Louisiana Polytech Inst, Ruston, p 31-43, . 13 p, 5 tab, 8 ref.

riptors: *Water reuse, *Municipal wastes, *Ir-ion water, *Salinity, Saline soils, Soil chemis-Water quality, Saline water, Water chemistry, contamination.
ifiers: Salinity hazard.

rograms of irrigation with municipal waste ef-nts, the build-up of soluble salts, which can in-se the osmotic pressure of the soil solution, can revented by providing for adequate drainage by applying enough excess irrigation water to tain a favorable salt balance. In humid areas, ainy season is likely to provide the necessary ning. Even with good drainage and sufficient ning to remove normal amounts of soluble . it is possible to have an accumulation of angeable sodium and precipitated or adsorbed y metals that can adversely affect the soil and s. A build-up of salts is very much less likely e an effluent is used to supplement normal all in humid areas than if it is used in an arid ite where irrigation supplies the major portion ie water required for a crop. Relatively low entrations of sodium and chloride salts applied iliage can cause harmful salt build-up on sensi-crops. Boron is of special concern when ef-t is used for irrigation because the tolerance rinking water can be greater than for irriga-There is a great variation in the salt content of ge that reaches different treatment plants and derable variation in that reaching a given ment plant. These variations are reflected in ffluent. Some of the soluble metal salts are ved by precipitation or chelation during the ment process. Zinc is most readily removed by treatment and nickel the least. Short term irrigation trials with effluent may fail to reveal a build-up potential. Accumulations of heavy metals in soils constitutes a unique hazard because of inadequate methods for reclamation. (Knapp-USGS)
W69-08618

PRACTICAL IRRIGATION WITH SEWAGE EFFLUENT,
Frank J. Gray.
Symp on Munic Sewage Effluent for Irrig, July 30, 1968, Louisiana Polytech Inst, Ruston, pp 49-56, 1968. 8 p.

Descriptors: *Water reuse, *Reclaimed water, *Municipal wastes, *Texas, *Irrigation water, Aesthetics, Odor, Nutrients, Soil chemistry, Water quality, Soil-water-plant relationships, Waste water disposal, Water pollution control, Artificial recharge.
Identifiers: *Lubbock (Tex).

The use of municipal sewage effluent for irrigation at Lubbock, Texas is described. The practice is successful in increasing crop yields, preventing pollution, improving soil conditions, and recharging groundwater. Disadvantages are steadiness of supply despite fluctuating demand, odor, difficulties in retaining agricultural laborers, and a few seedling growth problems. (Knapp-USGS)
W69-08619

GROUNDWATER RECHARGE WITH TREATED MUNICIPAL EFFLUENT,
Texas Technological Coll. Lubbock. Water Resources Center; and Texas Technological Coll., Lubbock. Dept. of Engineering.
Dan M. Wells.
Symp on Munic Sewage Effluent for Irrig, July 30, 1968, Louisiana Polytech Inst, Ruston, p 61-73, 1968. 13 p, 1 tab, 46 ref. OWRR Proj No A-009-LA.

Descriptors: *Water reuse, *Reclaimed water, *Municipal wastes, *Artificial recharge, Legal aspects, Aesthetics, Aquifers, Soil water movement, Groundwater movement, Infiltration, Water chemistry, Water quality, Soil contamination.
Identifiers: Waste water recharge.

Municipal effluent has always been used for groundwater recharge. Practically all of the recharge in the past has been unintentional, resulting from the natural operation of the hydrologic cycle, and it does not appear that this pattern will be appreciably changed in the future. It does appear, however, that the deliberate use of treated effluent for groundwater recharge will increase in the future, particularly in arid and semi-arid areas of the country that are rapidly depleting their groundwater resources. Although the technological capability for treating municipal effluent for any type of reuse including the recharge of potable groundwater supplies has existed for many years, many psychological problems remain to be solved to win public acceptance for its widespread use. Physical problems include clogging of soils of aquifers, chemical precipitation, and algal or bacterial growth. The legal problems include liability for damages to aquifers, ownership of recharged water, and ownership of effluent water. (Knapp-USGS)
W69-08620

THE MOVEMENT OF DISEASE PRODUCING ORGANISMS THROUGH SOILS,
California Univ., Davis, Dept. of Civil Engineering.
R. B. Krone.
Symp on Munic Sewage Effluent for Irrig, July 30, 1968, Louisiana Polytech Inst, Ruston, p 75-104, 1968. 30 p, 2 fig, 55 ref.

Descriptors: *Water reuse, *Pathogenic bacteria, *Viruses, *Groundwater movement, Municipal wastes, Irrigation water, Artificial recharge, Filtration, Sorption, Infiltration, Percolation, Soil disposal fields, Soil contamination, Soil physical properties.
Identifiers: Municipal waste recharge.

The movement of pathogenic organisms through soils recharged with contaminated water is discussed. Pathogens have a wide variety of physical and biological characteristics, including wide ranges of size, shape, surface properties, and die-away rates. The processes of filtration by soil include straining at the soil surface, straining at intergrain contacts, sedimentation, and sorption by soil particles. Straining of pathogens at the soil surface and sorption of viruses near the soil surface is desirable because it limits travel of pathogens most, and it is subject to wide variations in temperature and moisture, and it will assure aerobic conditions. A soil containing clay should therefore be used for irrigation with treated sewage. Wide experience in irrigation with treated sewage indicates that it is safe provided that at least primary treatment is used, and provided that the crops are not consumed directly by humans. Secondary treatment and chlorination is recommended for aesthetic reasons. (Knapp-USGS)
W69-08621

SURVIVAL OF PATHOGENS AND RELATED DISEASE HAZARDS,
Colorado Univ., Denver. Dept. of Microbiology.
Stuart G. Dunlop.
Symp on Munic Sewage Effluent for Irrig, July 30, 1968, Louisiana Polytech Inst, Ruston, pp 107-121, 1968. 15 p, 1 tab, 62 ref.

Descriptors: *Hazards, *Irrigation water, *Reclaimed water, *Municipal wastes, Pathogenic bacteria, Viruses, Parasitism, Waste treatment, Environmental sanitation.
Identifiers: Waste water irrigation.

The hazards to health caused by irrigation with reclaimed municipal waste water are surveyed. No disease outbreaks have been traced to irrigation with properly treated and disinfected sewage, but many epidemics have been caused by irrigation with improperly treated wastes. The same standards are recommended for effluents as for any other irrigation water. Survival times of pathogenic organisms in water are discussed and tabulated. (Knapp-USGS)
W69-08622

A TECHNICAL AND ECONOMIC FEASIBILITY STUDY OF THE USE OF MUNICIPAL SEWAGE EFFLUENT FOR IRRIGATION,
Soil Conservation Service, Searcy, Ark.; and Louisiana Polytechnic Inst., Ruston. Dept. of Agricultural Engineering.
Robert P. Cantrell, Charles W. Wilson, F. E. Beckett, and F. A. Calvo.
Symp on Munic Sewage Effluent for Irrig, July 30, 1968, Louisiana Polytech Inst, Ruston, p 135-156, 1968. 22 p, 1 fig, 3 tab, 19 ref, append.

Descriptors: *Water reuse, *Reclaimed water, *Municipal wastes, *Irrigation water, *Costs, Economics, Water pollution control, Nutrients, Water costs, Water wells, Legal aspects.
Identifiers: Ruston (La).

A study of technical and economic feasibility of irrigation reuse of Ruston, La. municipal wastewater effluents show that there are no significant technical problems. Neither corrosion nor salinity hazard to crops is expected to cause severe problems. Sprinkler irrigation using waste water is safe for field crops and pasture but is not recommended for fruits and vegetables. Furrow irrigation of fruit trees, as long as effluent does not contact the fruit, is acceptable. The cost of using effluents compares favorably with costs of other water sources. For the farms studied, average annual cost was $54.82 per acre, compared with $105.87 per acre for well water. This did not account for the fertilizer value of the effluent, which was about $17.50 per acre-ft. (Knapp-USGS)
W69-08623

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AN ENGINEERING-ECONOMIC ANALYSIS OF SYSTEMS UTILIZING AQUIFER STORAGE FOR THE IRRIGATION OF PARKS AND GOLF COURSES WITH RECLAIMED WASTEWATER,
Nevada Univ, Reno. Dept. of Civil Engineering; and Nevada Univ., Reno. Center for Water Resources Research.
Richard G. Orcutt.
Desert Res Inst Tech Rep HW-5, Nev Univ, Oct 1967. 123 p, 17 fig, 12 tab, 47 ref, 3 append. OWRR Proj No A-008-NEV.

Descriptors: *Water reuse, *Artificial recharge, *Irrigation water, *Arid lands, *Nevada, Mathematical models, Systems analysis, Model studies, Hydraulic models, Transmissivity, Aquifers, Groundwater movement, Water yield, Water quality, Water storage, Sanitary engineering, Water pollution, Optimization, Economics.
Identifiers: *Hele-Shaw models, Las Vegas (Nev).

An engineering-economic model of systems utilizing aquifer storage for the irrigation of public parks and golf courses with reclaimed municipal wastewater was developed and a computer program for the production costs for these systems was written. One model criterion was the essentially complete recovery of the injected water from the aquifer. A sensitivity analysis studied the effects of varying the input parameters, which represented decision variables and constants with uncertain values, upon the cost of reclaimed water. Preliminary feasibilities were studied for selected sites in Las Vegas, Nevada. A Hele-Shaw model was used to estimate the amount of groundwater withdrawal for essentially complete recovery of the injected reclaimed water. The benefits which might be attributed to the relief of sewerage by wastewater reclamation systems in Las Vegas, Nevada, were estimated. The model rapidly determines the cost effect of varying about 40 input parameters. A significant finding is the important influence which the injection rate, particularly for rates under 0.75 cfs per well, has upon water cost. The successful development of reclamation-reuse systems utilizing aquifer storage will require close cooperation between the agency which is responsible for the project and public health agencies at all levels. A complete Fortran program listing for the mathematical model is included. (Knapp-USGS)
W69-08625

5E. Ultimate Disposal of Wastes

SEWAGE DISPOSAL SYSTEMS NEAR SHORELINES.

NH Rev Stat Ann secs 149-E:1 thru 149-E:8 (Supp 1967).

Descriptors: *New Hampshire, *Water pollution sources, *Sewage disposal, *Sewage treatment, Sewage, Legislation, Wastes, Municipal wastes, Water pollution control, Disposal, Environmental engineering, Waste water disposal, Shores, Shore protection, Administrative agencies, Planning, Land development, Soil contamination, Soil contamination effects, Jurisdiction, Legal aspects.

The purpose of this chapter is to prevent water pollution by inadequate waste disposal systems near shorelines. Anyone proposing to subdivide land or construct a sewage disposal system near any shoreline shall submit such plans for approval by the Water Supply and Pollution Control Commission. The disposal systems shall be constructed in accordance with the approved plans. The commission shall notify the person submitting plans of their approval or disapproval. No plans shall be required when the system will be connected to a public sewer system. The commission will require the submission of any soil data from any subdivision to be built. Anyone aggrieved by the decision of the commission may appeal in accordance with the established procedure. The commission shall be empowered to: (1) supervise and enforce this chapter; (2) employ necessary personnel; (3) adopt, after public hearings, rules and standards to implement this chapter; and (4) prohibit construction of any sewage system which would cause pollution. Upon certification by the commission, local officials may exercise concurrent jurisdiction with the commission in enforcing this chapter. Violations of these provisions shall be punishable by a fine and the acts may be enjoined. (Helwig-Fla)
W69-08154

STATUS OF RADIOACTIVE WASTE DISPOSAL IN U.S.A.,
Vanderbilt Univ., Nashville, Tenn. Dept. of Sanitary and Water Resources Engineering.
Frank L. Parker.
ASCE Proc, J Sanit Eng Div, Vol 95, No SA3, Pap No 6597, pp 439-464, June 1969. 26 p, 9 fig, 5 tab, 60 ref.

Descriptors: *Radioactive waste disposal, *Reviews, *Bibliographies, Systems analysis, Waste disposal, Injection wells, Monitoring, Regulation, Radiochemical analysis, Pollutant identification, Water pollution control.
Identifiers: Underground grouting (Disposal).

The present state of radioactive waste disposal practices is reviewed. The main emphasis in research in liquid radioactive waste management has been on the feasibility of conversion of liquids to solid form before disposal and in place underground, and monitoring of disposal and pollution effects. For gaseous wastes, the emphasis has been on the removal of the various forms of iodine in the off-gas systems and the development of new methods for noble gas removal. For solid waste disposal, better containment has been sought, and private burial operations have been transferred to commercial burial grounds. The management of radioactive wastes has not proven to be a deterent to a nuclear power economy. The major problems remaining are methods of the removal of noble gases and tritium, development of methods of fuel reprocessing, and understanding of the movements of radionuclides in the environment. (Knapp-USGS)
W69-08214

5F. Water Treatment and Quality Alteration

PRACTICAL ALGAE CONTROL METHODS FOR NEW HAMPSHIRE WATER SUPPLIES,
New Hampshire Water Supply and Pollution Control Commission, Concord.
For primary bibliographic entry see Field 05C.
W69-08282

CLASSIFICATION OF WATERS AND STANDARDS OF PURITY.

SC Code Ann secs 70-112 thru 70-122 (1962), as amended, (Supp 1968).

Descriptors: *South Carolina, *Water pollution control, *Classification, *Standards, Administration, Administrative agencies, Legislation, Control, Regulation, Water quality, Water pollution, Sewage treatment, Water quality control, Water resources, Bodies of water, Streams, Bacteria, Biochemical oxygen demand, Chemical oxygen demand, Outlets, Abatement, Legal aspects, Water law, Water purification, Water utilization, Permits, Waste disposal, Waste identification.

The Pollution Control Authority shall group designated waters into classes according to the best usage in the public interest. Standards of quality and purity shall be established for the different classes in relation to the present and potential public use and benefit of such waters. The standards adopted may prescribe: (1) the extent of floating solids; (2) the extent of suspended solids; (3) the extent of bacteria allowed; (4) the extent of oxygen demand; (5) other properties of the water. In classifying the waters consideration shall be given to the size, depth, rate of flow, use
present defilement of the waters, and the geol
cal character and present use of the district bo
ing such water. It shall be unlawful to po
waters in contravention of the standards set b
Authority. Anyone desiring to make a new se
outlet to discharge into any waters shall appl
and receive a permit from the Authority to d
The Authority shall approve all plans for cons
tion, addition to or change in any sewage or w
disposal system. If anyone can show it impossib
comply with the standards as to treatme
sewage, because no adequate method is known
Authority shall withhold abatement orders f
period of not more than 5 years, such period b
subject to extention. (Helwig-Fla)
W69-08353

**CRUSHED LIMESTONE BARRIERS: A BA
FEASIBILITY STUDY IN THE NEUTRALI
TION OF ACID STREAMS,**
Pennsylvania State Univ., University Park. Inst
Research on Land and Water Resources.
For primary bibliographic entry see Field 5G.
W69-08376

**OPTIMAL TAXING FOR THE ABATEMENT
WATER POLLUTION,**
Carnegie-Mellon Univ., Pittsburgh, Pa.
Jerome E. Hass.
PhD Dissertation, Carnegie-Mellon Universit
75-131, June 1969. 57 p, 11 tab, 49 ref.

Descriptors: *Taxes, *Optimization, *Econo
*Pollution abatement, Simulation analysis, Ma
matical models, Pollutants, Water resources, L
aspects, Political aspects, River basins.
Identifiers: Miami River.

The problem of allocating the costs of mainta
river basin quality standards was examine
mathematical model was developed for deter
ing the minimum cost method of meeting st
quality standards when the Central Authority
no information regarding the waste treatment
at each waste source. Taxes were found to b
best legal, political and economically justif
tool. An algorithm was included in the analys
determine the tax structure required for achi
a solution in a decentralized fashion. The net r
was an operationally systematic method for a
tral water authority to follow in order to effici
allocate assimilative capacity of the stream. S
lation techniques were employed. Using the m
taxes could also be levied, to yield optimal t
ment configurations without knowing all the
pertaining to treatment cost. (Thiuri-Cornell)
W69-08547

THE ECONOMICS OF CLEAN WATER,
Scott Paper Co., Philadelphia, Pa.
N. J. Lardieri.
Proc, Water Resources Seminars, 1967-1968,
98, Univ Del, Newark, December 1968. 18
fig.

Descriptors: *Economics, *Water resources,
lution abatement, *Cost-benefit analysis, *M
matical models, *Optimization, Analog comp
Digital computers, Water quality control, Re
tion, Delaware River.

Economic techniques for estimating costs for
ing federal water pollution control standard
the potential for minimizing these costs bas
the Delaware Estuary were presented. Cost b
studies were conducted by municipal source
estimates of recreation, fish and wildlife be
expected from the improved level of water q
were made. Mathematical models employin
analog and digital computers were used for o
ing total costs of attaining water quality obje
under three different removal schemes n
uniform treatment, zonal approach and
minimization. The summary of cost-benefi
pointed out that requiring uniform treatmen

ischarges is the most expensive of all solutions, incremental benefits from higher water quality negligible compared to the costs required to eve them. (Thiuri-Cornell)
9-08548

OUNDWATER RECHARGE WITH EATED MUNICIPAL EFFLUENT,
as Technological Coll. Lubbock. Water ources Center; and Texas Technological Coll., bock. Dept. of Engineering.
primary bibliographic entry see Field 05D.
9-08620

VIVAL OF PATHOGENS AND RELATED EASE HAZARDS,
orado Univ., Denver. Dept. of Microbiology.
primary bibliographic entry see Field 05D.
9-08622

. Water Quality Control

TER POLLUTION CONTROL.

USCA secs 466, 466-1, 466-a, 466-b, 466c pp 1969).

criptors: *Federal government, *Water pollu- control, *Water policy, *Pollution abatement, tement, Legislation, Water law, Legal aspects, ninistrative agencies, Water quality control, ninistration, Political aspects, State govern- nts, Local governments, Financing, Water pu- ation, Allotments, Economics, Grants, Model lies, Planning, Projects, Federal project policy, ject planning, Project purposes, Interstate com- ts.

ted States congressional policy contemplates enhancement of the quality and value of our na- al water resources through the prevention, con- , and abatement of water pollution. It is also eral policy to recognize and preserve the prima- responsibilities and rights of the states in venting and controlling water pollution through to them in technical research, services and ncing. Grants are available to state and local ernments to assist in the development of pro- s which demonstrate new or improved methods ontrolling the discharge into any waters of un- ted sewage, and development of advanced te treatment and water purification methods. Secretary of the Department of Health, Educa- and Welfare is to prepare and develop com- hensive programs for eliminating or reducing pollution of interstate waters and improvement the sanitary condition of surface and un- ground waters. He is partially advised in these ters by the Federal Water Pollution Control ministration. The secretary promotes interstate peration with respect to uniform state laws, e compacts, research, experiments, and studies may initiate investigations in a number of blem areas relating to water pollution. (John- -Fla)
9-08127

W ENGLAND INTERSTATE WATER POL- TION CONTROL COMPACT.
Stat Ann tit 10, secs 991-1002 (1958), as nded, (Supp 1968).

criptors: *Vermont, *Interstate compacts, ater pollution control, *New England Interstate S Compact, New England, Connecticut, Maine, sachusetts, New Hampshire, Rhode Island, York, Abatement, Interstate commissions, In- tate rivers, Interstate cooperatives, State rnments, Water policy, Standards, Water ity, Water pollution, Classification, Tidal rs.

states of New England join in this compact to e and control pollution in their interstate rs. The compact shall apply to waters contiguous to or flowing through two or more signatory states. Each signatory state shall be represented on the commission. The commission shall meet, conduct business, promulgate rules and make reports as required and as necessary for its purposes. The commission shall be financed by the signatory states and its records subject to audit by each member. The commission shall establish physical, chemical and bacteriological standards of water quality for the various classifications of water. Each signatory state will classify its interstate waters by use, subject to approval by the commission. Each state pledges to abate pollution in interstate inland and tidal waters. Nothing herein shall prevent any signatory state from imposing additional restrictions to further reduce pollution in its waters. The commission may cooperate with New York in pollution abatement of common waterways. The compact was adopted by Vermont on June 29, 1951. (Helwig-Fla)
W69-08151

LOCAL PROVISIONS.
SC Code Ann secs 70-311 thru 70-491 (1962), as amended, (Supp 1968).

Descriptors: *South Carolina, *Water districts, *Water distribution (Applied), *Cities, Boats, Lakes, River, High water mark, Low water mark, Swimming, Dams, Dikes, Canals, Reservoirs, Water conservation, Water control, Watercourses (Legal), Water resources development, Water pollution, Water pollution control, Water management (Applied), Water supply, Water wells, Public utilities, Wildlife, Domestic water, Easements.
Identifiers: Penalties (Criminal), Life preservers, Motor boats.

Regulations are promulgated for boating in various waters of the state. The carrying of life preservers and the use of motor boats are regulated. Authorization is given establishing several local water authorities. The authorities may construct reservoirs, dams, dikes, canals, tunnels, or whatever they deem necessary for the proper distribution of both domestic and industrial water. The terms and compensation of the authorities members are enumerated along with their specific powers. Among these are the powers to: (1) impound fresh water; (2) maintain water distribution systems; (3) protect the waters from pollution; (4) lease, sell or convey land; (5) exercise the power of eminent domain and; (6) borrow money and issue negotiable bonds. The authority may charge reasonable rates for its services. Other provisions are made for local water districts, and regulations are made regarding water diversion and well digging. (Shevin-Fla)
W69-08155

STATE BOARD OF HEALTH: WATER.

17 SC Code Ann 308-314 (1962).

Descriptors: *Water treatment, *South Carolina, *Domestic water, *Water quality control, Public health, Cities, Water supply, Engineering, Cesspools, Reservoirs, Water consumption, Water pollution, Chlorination, Chemical analysis, Bacteria, Biological treatment, Sewers, Flouridation, Construction, Pumping, Wells, Water works, Water sources, Tidal waters, Springs, Legislation.
Identifiers: Savannah River Project.

Regulations are promulgated for the establishment of any waterworks that will furnish water for domestic use. All plans for building or improving water purification plants or altering the water source supply shall be submitted for approval to the State Board of Health. The application must provide complete details of the proposals including estimates of the per capita consumption for the future and chemical and bacteriological analyses of the water source. Before being placed into service all new water distribution systems must be sterilized. The method of sterilization is set forth. No flourides may be added to the water supply unless approval is first obtained from the Board of Health. No water furnished for domestic use may contain impurities which may injuriously affect public health. Steps must be taken to amply protect the water sources from pollution. The area surrounding the Savannah River Project is designated an emergency area and is subject to certain special regulations in regards to water supply and sewage disposal. The tidal waters of the state are classified. (Shevin-Fla)
W69-08166

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO V UNITED STATES STEEL CORPORATION (INDUSTRIAL WATER POLLUTION).

41 111 2d 440, 243 NE2d 249-252 (1968).

Descriptors: *Illinois, *Pollution abatement, *Water policy, *Water pollution control, Abatement, Judicial decisions, Water pollution, Legislation, Administrative agencies, Water quality control, Legal aspects, Water law, Impaired water quality, Pollutant identification, Riparian rights, Water pollution effects, Public rights, Potable water, Water purification, Filtration, Financial analysis, Costs, Lake Michigan.
Identifiers: *Injunctions.

PLAINTIFF, Metropolitan Sanitary District of Greater Chicago, was awarded a temporary injunction in the circuit court against defendant corporation restraining it 'from polluting waters of Lake Michigan by discharging any oil or oily substances into the waters' of the lake. The sanitary district alleged that such oil or oily substance was visibly floating on the surface of the lake. The circuit court found that an oil slick was coming out of the defendant's north slip into Calumet Harbor and covering an area of six thousand feet by fifty feet, but that the discharge was unintentional. In that court an expert witness testified that the slick, if continuously fed, would reach the intake of the south side water filtration plant of the city in a few days. If this occurred special filtration would be necessitated. The State Supreme Court in affirming the circuit court held that the statute, giving the district the power to prevent pollution of the sources of the city's water supply, gave authority for the district to get an injunction to prevent industrial pollution and that the statute was compatible with the federal statute relating to control of water pollution. (Johnson-Fla)
W69-08172

A REVIEW OF THE LITERATURE OF 1968 ON WASTEWATER AND WATER POLLUTION CONTROL.
Federal Water Pollution Control Administration, Washington, D. C. Research Committee.
For primary bibliographic entry see Field 05D.
W69-08199

ENVIRONMENTAL PROTECTION FOR NUCLEAR APPLICATIONS,
Harvard School of Public Health, Boston, Mass. Kresge Center for Environmental Health.
Dade W. Moeller, and Abraham S. Goldin.
ASCE Proc, J Sanit Eng Div, Vol 95, No SA3, Pap 6589, pp 373-385, June 1969. 13 p, 2 tab, 23 ref.

Descriptors: *Radioactive wastes, *Radioactive waste disposal, *Regulation, *Radiochemical analysis, Water pollution control, Water pollution sources, Abatement, Legislation, Standards, Monitoring, Pollutant identification.
Identifiers: Radioactive waste disposal standards.

Current environmental protection recommendations for nuclear applications are summarized and areas needing further research and development are reviewed in detail. Areas needing work are the improvement and simplification of surveillance, identification of pollutants, tracing of pollutants to their sources, application of standards, and

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development of counter measures for accidental releases. (KnappnUSGS)
W69-08212

REGIONAL WATER QUALITY STANDARDS,
Delaware River Basin Commission, Trenton, N. J. Water Quality Branch.
Ralph Porges.
ASCE Proc, J Sant Eng Div, Vol 95, No SA3, Pap No 6596, pp 423-437, June 1969. 15 p, 7 fig, 10 ref.

Descriptors: *Standards, *Water quality, *Water quality act, *Delaware River, Streams, Estuaries, Water pollution sources, Water pollution control, Dissolved oxygen, Streamflow, Regulation, Water management (Applied), Waste Disposal, Water treatment.
Identifiers: Delaware River Basin.

The Delaware River Basin encompasses many clean streams and a major pollution problem in the 85 mile long Delaware estuary. Water quality management concepts applied in the development of regional water quality standards included protection of clean streams, abatement of polluted waters, a minimum required degree of wastewater treatment, and the equitable apportionment of stream assimilative capacity. The Delaware River Basin Commission adopted water quality standards and regulations setting forth water uses to be protected, water quality criteria necessary to protect water uses, effluent quality requirements, and allocations of stream assimilative capacity. (Knapp-USGS)
W69-08213

RATIONALE OF STANDARDS FOR USE OF RECLAIMED WATER,
California State Dept. of Public Health, Berkeley. Bureau of Sanitary Engineering.
For primary bibliographic entry see Field 05D.
W69-08215

PUBLIC HEALTH FACTORS IN REACTOR SITE SELECTION,
Public Health Service, Rockville, Md. Div. of Environmental Health.
J. G. Terrill, Jr., C. L. Weaver, E. D. Howard, and J. M. Smith.
ASCE Proc, J Sanit Eng Div, Vol 95, No SA3, Pap No 6620, pp 545-561, June 1969. 17 p, 3 fig, 3 tab, 25 ref.

Descriptors: *Radioactive waste disposal, *Regulation, *Standards, *Water pollution sources, *Public health, Legislation, Environmental engineering, Radioactivity effects, Safety, Social aspects, Urbanization.
Identifiers: Reactor site selection, Public health considerations.

Factors of specific concern in the design and operating characteristics of nuclear plants to Federal, State, and local health agencies include physical and demographic site characteristics, potential air, water, land, and food contamination, land use, zoning, and exposure pathways. These factors must be considered to assure that the operation of one or more reactors at the selected site will not adversely affect the population and environment surrounding the plant. Research programs at operating power reactors are being coordinated to determine the methodology and analytical techniques required for an optimum surveillance program. The nuclear facility operator in cooperation with the State health agency should have a planned and rehearsed emergency plan which can be placed into effect to minimize adverse consequences in the event of an accident. (Knapp-USGS)
W69-08216

SEWERAGE AUTHORITIES LAW.

NJSA secs 40:14A-2, 40:14A-6, 40:14A-20, 40:14A-28 (1967).

Descriptors: *New Jersey, *Pollution abatement, *Water pollution, *Treatment facilities, Legislation, Water pollution control, Public health, Water purification, Local governments, Waste treatment, Impoundments, Administrative agencies, Condemnation, Eminent domain, Public utilities.
Identifiers: Service charges.

The purpose of this act is to relieve water pollution by all reasonable means in waters in or bordering the state. Counties and municipalities are authorized to construct and operate sewage treatment facilities and, if necessary, works for the impounding, transportation and release of water for the replenishment of waters diverted into a sewage facility. The sewage authorities are given the power of condemnation. (The discharge by municipalities, counties or persons of sewage which may cause pollution is prohibited.) The discharge of any matter which may be harmful to the sewage system or its efficient operation is prohibited. (Childs-Fla)
W69-08313

STATE OF NEW HAMPSHIRE V ATOMIC ENERGY COMM'N (EVIDENCE OF POSSIBLE THERMAL POLLUTION NOT WITHIN JURISDICTION OF AEC).

406 F 2d 170-176 (1st Cir 1969).

Descriptors: *Federal jurisdiction, *Thermal pollution, *Nuclear reactors, *Administrative agencies, Judicial decisions, Permits, Administrative decisions, Nuclear wastes, Water pollution sources, Electric power plants, Electric power industry, Water temperature, Heated water, Temperature control, Environmental engineering, Water pollution effects, Oxygen sag, Fishkill, Cooling towers.
Identifiers: *Atomic Energy Commission.

Plaintiff sought review of an order of the Atomic Energy Commission of defendant's order which granted defendant a permit for the construction of a nuclear power reactor by several privately owned utility companies. New Hampshire argued that the operation of the reactor without a cooling tower facility would harm the natural resources of the Connecticut River by causing thermal pollution. The Atomic Energy Commission claimed that such evidence related to matters beyond its jurisdiction and granted the permit without considering the plaintiff's demands. The Commission held that neither the Water Quality Act of 1965 nor Executive Order 11288 were applicable to reactors which the Commission did not own or operate. This court affirmed the Commission's order. No licensing by the Commission acts to relieve the licensee from complying with federal or state water pollution control regulations. Though the Atomic Energy Act refers repeatedly to the 'health and safety of the public,' it does not define these terms. This lack of definition and the legislative history of the act indicated that the terms health and safety had reference to radioactive hazards, not thermal pollution. (Blunt-Fla)
W69-08316

PROTECTING WATER AND ICE SOURCES.

NH Rev Stat Ann secs 148:1 thru 148:37 (1964), as amended (Supp 1967).

Descriptors: *New Hampshire, *Public health, *Water supply, *Water quality control, Domestic water, Water pollution control, Legislation, Regulation, Adjudication procedure, Reservoirs, Lakes, Sewage treatment, Cities, Water analysis, Ice, Administrative agencies, Water sources, Ice fishing, Wells, Road construction, Water pollution, Drainage, Interstate rivers, Ponds, Surface waters.
Identifiers: Injunctions (Mandatory), Penalties (Criminal).

The department of health and welfare, division public health services, has authority over the pub water and ice supply and the sewage systems of t cities. Regulations must be complied with when cutting for domestic use and of the domestic wa supply. It is unlawful to pollute water used public drinking purposes. The division may amine all water supplies to determine if they suitable for public consumption and establish re lations necessary to protect the public health. T division may require such improvements in t water supply systems and sewage systems as deems necessary for public health. It must appro construction plans for water supply systems a sewage systems. It may inspect emergency wa sources and the valves which control the inflow such water into the water supply. The division m approve plans to discharge pollution into the stat waters and it must see that all wells are prope fenced. (Shevin-Fla)
W69-08348

PROTECTING WATER AND ICE SOURCES.

NH Rev Stat Ann secs 148:1 thru 148:14 (196 as amended, (Supp 1967).

Descriptors: *Water supply, *Ice, *N Hampshire, *Public health, Water quality contr Domestic water, Cities, Regulation, Polluti abatement, Water pollution, Legislation, Lak Ponds, Reservoirs, Water wells, Rivers, Flouri Boats, Fishing, Swimming, Sewage, Chemical an ysis.
Identifiers: Penalties (Criminal), Injunctions.

A person placing any substance harmful to water any pond or reservoir from which the city's wa supply is taken is subject to fine and/or imprisc ment. The board of health may remove the su stance and charge the cost of such removal to t person who placed it there. A person willfully p luting the water or ice supply of any city may fined and/or imprisoned. No person shall cut i from any reservoir used as a public water supp unless first complying with local regulations rega ing such cutting. No flourine shall be introduc into the public water supply unless a public hear has first been held. Local boards may make rules regard to fishing, boating and ice racing on lak ponds and reservoirs. No person shall bathe waters protected for use as a public water supp Any person injuring any property of the water co pany shall be subject to penalties. The board health shall inspect areas from which ice is to cut and determine if the sources of such supply m be deleterious to public health. Persons cutting from areas deemed polluted shall be subject to fi and/or imprisonment. The board may have a water supply analyzed to determine if it is safe consumptive use. (Shevin-Fla)
W69-08349

PROTECTING WATER AND ICE SOURCES.

NH Rev Stat Ann secs 148:15 thru 148:25a (196 as amended (Supp 1967).

Descriptors: *New Hampshire, *Public heal *Water sources, *Water quality, Legislatio Water supply, Ice, Water pollution, Regulation, terstate rivers, Lakes, Ponds, Reservoirs, Draina Wells, Cities, Water quality control, Sewage tre ment, Adjudication procedure, Surface wate Chlorination, Sewage systems, Road constructio Sewers.

When it is believed that a public water supply contaminated and local regulations will not be s ficient to abate the condition, a petition may filed with the Department of Health and Welfare investigate the situation and make necessary re lations. Any regulations so promulgated shall be force after due notice is given. The departm may make regulations for the protection of terstate waters used as a source of public drink water by adjoining states. The department m prohibit the use of certain wells, springs or ot

urces of water from being used as a source of omestic water if it finds such source to be pol-ted. The department may examine the conditions all water supply sources and sewage systems and quire that certain improvements be made to in-re adequate protection of public health. All blic water supply systems must be provided with sinfection facilities. Any person constructing a ater supply or sewage system must submit his ans to the department for approval. No highway all transverse an area used for storage of public inking water without the approval of the depart-ent. (Shevin-Fla)
69-08350

ROTECTING WATER AND ICE SOURCES.
H Rev Stat Ann secs 148:26 thru 148:37 (1964), amended, (Supp 1967).

escriptors: *New Hampshire, *Water sources, Water quality, *Water supply, Water quality con-ol, Valves, Flow control, Regulation, Public ealth, Intakes, Water pollution, Sewage, Streams, akes, Ponds, Rivers, Water pollution control, ells, Adjudication procedure, Administrative encies, Legislation.
entifiers: Emergency water sources, Emergency ater supply, Penalties (Criminal).

o person, supplying water to the public for omestic use, may maintain a connection through hich water may be received from an auxiliary ource, unless such source has been approved by e division of public health services. Every valve, other device for controlling the inflow of water an unapproved character to the public supply pe system must be of such construction to permit ficient inspection, and must be inspected at least ice annually. All valves used in connection with ources maintained for fire protection shall be sub-ct to the seal of the division and whenever such al is broken the division must be notified within 4 hours. The division may order the abandonment emergency sources when deemed necessary for e public health. No person shall discharge sewage to the waters of the state without first receiving pproval of the plans for the discharge by the de-artment of health. No wells may be maintained nless they are sufficiently protected by fencing so onstructed that no child can crawl through or nder it. (Shevin-Fla)
69-08351

OLLUTION CONTROL AUTHORITY OF OUTH CAROLINA.
C Code Ann secs 70-101 thru 70-111 (1962), as mended, (Supp 1968).

escriptors: *South Carolina, *Water pollution ontrol, *Pollution abatement, *Administrative gencies, Air pollution, Water pollution, Water ollution effects, Water pollution treatment, ewage, Sewage treatment, Regulation, Legisla-on, Water quality, Federal government, State overnments, Legal aspects, Water utilization, Vater purification, Standards, Public health, ublic benefits, Conservation, Streams, Fish, Wil-life, Waste disposal, Projects, Federal project pol-y
lentifiers: *Federal Water Pollution Control Act.

is the policy of the state that reasonable stan-ards of purity of the waters be maintained con-stent with public health, public enjoyment, pro-ection of fish and wildlife and operation of indus-y. Reasonable methods of pollution prevention nd control shall be used. The Pollution Control uthority is created to abate and control the pollu-on of state waters and air. The authority shall dopt rules toward this goal and shall set standards f purity for all streams. The Authority shall have ne power to safeguard the waters and air from pol-ition; control sewage discharge; institute actions o compel compliance with this act; issue permits or discharge of wastes; cooperate with the federal r other state governments regarding pollution control; conduct studies and research regarding pollution; develop a comprehensive program of pollution abatement; approve plans for waste disposal system; approve projects for loans under the Federal Water Pollution Control Act; participate in proceedings under the Federal Water Pollution Control Act; consent, on behalf of the state, to requests by the federal government for bringing suit for abatement of pollution. The Authority shall do all acts necessary to secure the benefits of the federal act. (Helwig-Fla)
W69-08358

POLLUTION, POISONING, ETC., OF STREAMS; DYNAMITING.

SC Code Ann secs 28-671 through 28-677, (1962).

Descriptors: *South Carolina, *Explosives, *Pollutants, *Poisons, Water pollution control, Water pollution sources, Fish, Fishkill, Fish toxins, Fish conservation, Shellfish, Legislation, Legal aspects, Fishing, Streams, Lakes, Rivers, Boats, Inland waterways, Public benefits, Electrical shocking gear.
Identifiers: Dynamiting.

It shall be unlawful for any person to cause poison or any other deleterious matter to enter any fresh or salt water of the state frequented by game fish, in a quantity sufficient to kill or stupefy any such fish of shellfish. The captain of any ship shall be responsible for any discharge of such substances from his vessel. Violators will be subject to fine and/or imprisonment. It is unlawful to poison the waters of the state in any manner for the purpose of taking fish. If any person casts impurities, poisonous to fish, into the waters of this state he shall be subject to fine or imprisonment. It shall be unlawful for any person to use explosives to take fish or to aid anyone else in doing the same or to possess such explosives on any vessel usually used for fresh-water fishing. Violators shall be guilty of a misdemeanor. If any person is found picking up fish within 2 hours after an explosion, it shall be deemed prima facie evidence of a violation of the above. Any person convicted of using explosives shall be prohibited from hunting or fishing within the state for 5 years. Anyone failing to report dynamiting used to unlawfully take fish within 2 weeks thereafter shall be guilty of a misdemeanor. Informers shall not be subject to prosecution for slander or malicious prosecution or subject to civil action for damages to the person so accused of using explosives. (Carruthers-Fla)
W69-08366

MISCELLANEOUS PROVISIONS (UNLAWFUL DISCHARGE OF OIL IN CHARLESTON HARBOR).

SC Code Ann secs 54-451 thru 54-458 (1962).

Descriptors: *South Carolina, *Harbors, *Oily water, *Docks, Ships, Pollution abatement, Pollutants, Legislation, Regulation, State governments, Damages, Rates, Salaries, Ships, Boats, Navigation, Transportation, Navigable waters.
Identifiers: Penalties, Liens, Wharfingers.

Charleston is declared to be the State port of South Carolina. To discharge oil from any vessel while within a harbor of this state is unlawful. Violation of this provision is punishable by fine not exceeding $500 which shall become a lien upon such vessel. It shall be unlawful to discharge oil any place within this state from which it shall drain into a harbor in any county containing a city with more than 60,000 population. Violation is punishable by fine not exceeding $500 and/or imprisonment not exceeding 6 months. If any person is injured through the mismanagement or negligence of the person in charge of a steamboat, the person in charge shall be punished by fine and/or imprisonment. Beaufort County shall build wharves at Buchingham Ferry and Jenkins Island to permit the docking of steamboats. Wharfingers shall be appointed at such wharves. Their salaries shall be paid from funds collected from boats docking at such wharves. (Kahle-Fla)
W69-08373

CRUSHED LIMESTONE BARRIERS: A BASIC FEASIBILITY STUDY IN THE NEUTRALIZATION OF ACID STREAMS,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
R. Rupert Kountz, Robert E. Jarrett, and Alan F. Yen.
Institute for Research on Land and Water Resources, Research Project Partial Technical Completion Report, University Park, Pa., June 1969, 3 p, 1 ref. OWRR A-002-PA.

Descriptors: *Limestones, *Barriers, *Neutralization, *Acidic water, Mine drainage, Chemical reaction, Flow rates, Hydraulic models, Backwater, Coal mine wastes.

This project revealed that crushed limestone barriers can be used in streams contaminated with acid mine drainage to reduce the acidity in the water. Studies were limited to acidity concentrations less than 1,000 mg/1. Ferrous ion does not interfere with the neutralization process. However, ferric ion does interfere with it and will eventually render the limestone impotent because of a surface coating of iron oxide. Hydraulic model studies of barriers provided data on backwater depth, flow surfaces, flow rates, barrier lengths, and stone sizes. These studies indicated a barrier installation could have any reasonable number of units and be of such stone size as to be compatible with the site topography. The Commonwealth of Pennsylvania is constructing a prototype barrier installation based on the data developed in this project. (Pollard-Penn State Univ)
W69-08376

BIOLOGICAL OXIDATION RATES IN MINE ACID WATER REGIMES,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
R. Rupert Kountz, Lee Rosenberger, and W. A. Eberhardt.
Institute for Research on Land and Water Resources, Research Project Technical Completion Report, University Park, Pa., June 1969, 28 p, 25 ref, 4 tab, 7 fig, 1 append. OWRR A-001-PA.

Descriptors: *Biological treatment, *Mine wastes, *Self-purification, *Acid streams, Water purification, Iron, Organic wastes, Aerobic conditions.
Identifiers: *Velocity constants, Streeter-Phelps.

The velocity rate constants for biological oxidation were evaluated by employing synthetic sewage and laboratory simulated acid mine water regimes. Lowering of pH decreases the value of the rate constants until a maximum reduction of 65 percent is obtained at pH value of 4.0. Increasing concentrations of ferric ion cause a further, but small decrease in the rate constant. It was demonstrated that biological oxidation does occur in streams contaminated with acid mine drainage; consequently, the permissable discharge loadings can be calculated (by employing the reduced rate constants) either by manual computation, or the stream stretch can be developed with an analog computer programming. (Pollard-Penn State Univ)
W69-08379

WATER USE AND RELATED COSTS WITH COOLING TOWERS,
Illinois State Water Survey, Urbana, Ill.
Brian Berg, Russell W. Lane, and Thurston E. Larson.
Journal of the American Water Works Association, Vol 56, No 3, pp 311-328, March 1964. 18 p, 9 fig, 5 tab, 10 ref.

Descriptors: *Cooling towers, *Water cooling, Economics, Water treatment.

LIBRARY U OF I, URBANA-CHAMPAIGN

Identifiers: Once-through-cooling, Cooling tower concentration, Makenup water.

The authors made an economic evaluation of cooling towers for water reuse compared with once-through use. The location used in this report is northeastern Illinois. The report presents a method in which the approximate costs for specific cooling-tower applications may be estimated and compared with the costs of nonconservative practices. Chemical savings could be realized if mineral concentrations in the cycled cooling water were increased 5 to 10 times. In the refrigeration industry, evaporative, or air-cooled condensers are quite often economically competitive with the smaller cooling towers (10-100 tons). For maximum economy, optimum size match is desired between the equipment to be cooled and the heat dissipation equipment. Due to this, a competent engineer should be hired to study the specific cooling needs in detail. It is suggested that if the cost of both once-through and conservation equipment are within 30 percent of each other, there should be a thorough investigation. (Ross-Vanderbilt)
W69-08407

CHINKING UP SOME CRACKS,
Federal Water Pollution Control Administration, Washington, D. C. Div. of Technical Control.
For primary bibliographic entry see Field 06A.
W69-08539

WATER POLLUTION CONTROL IN THE TEXTILE INDUSTRY,
American Textile Manufactures Inst., Charlotte, N. C.; and Burlington Industries, Inc., Greensboro, N. C.
R. W. Armstrong, and D. Byrd.
Textile Chemist and Colorist Vol 1, No 6, p 142/21-145/24, March 12, 1969. Based on a symposium, February 26-28, 1969, sponsored by A.A.T.C.C. and US Departments of Commerce and Interior.

Descriptors: Water pollution control, *Water pollution sources, Water pollution treatment, Biochemical oxygen demand.
Identifiers: *Textile wastes.

In the last ten years, the textile industry has made great strides in cleaning up waste waters. This massive campaign was initiated in order to comply with federal and state regulations concerning the pollution of our nations rivers and lakes. Although great progress has been made in this field, the textile industry is still subject to much criticism from small newspapers, radio and television. These charges, which are often false, have been leveled because of the textile industries poor history concerning the pollution of streams. In order to build a clean image, the industry must clean-up America's waterways and then must establish good public relations with the news media to inform the public of the work which is being done to solve the pollution problem. (Goodwin-NC State Univ)
W69-08552

THE AVAILABILITY OF QUALITY WATER IS IMPORTANT IN PICKING A PLANT SITE,
Lockwood Greene Engineers, Inc., Spartanburg, S. C.
T. A. Fridy.
Textile Chemist and Colorist, Vol 1, No 7, p 185/40-187/44, March 26, 1969. Based on a symposium, February 26-28, 1969, sponsored by A.A.T.C.C. and US Departments of Commerce and Interior.

Descriptors: *Economics, *Treatment facilities, *Sites, Flow rates.

This article discusses the aspects which should be considered when picking a plant site. The geographic location influences the need for weather protection and design of mill. The topography has a bearing on the cost of operation and development. The surrounding industries and communities should also be investigated to insure that there is no major conflicts over waste disposal. The existing utilities and capacity to deliver necessary power, chemicals and water should be investigated. Finally, stream flow rates and other mandatory requirements should be studied. (Goodwin-NC State Univ)
W69-08553

WATER QUALITY MANAGEMENT IN VIRGINIA,
Virginia Water Control BOARD, Richmond, Va.
A. H. Paessler.
Textile Chemists and Colorist, Vol 1, No 7, p 181/35-184/38, March 26, 1969. Based on a symposium, February 26-28, 1969, sponsored by A.A.T.C.C. and US Departments of Commerce and Interior.

Descriptors: *Dissolved oxygen, *Standards, *Water quality, *Water temperature, *Water quality control, *Water management (Applied), Sampling, Nutrients, Analysis, Flow rates.

The Virginia State Water Control Board administrative set-up is described and compared with water quality management agencies in other states. In order for such an organization to function, it was necessary to establish standards for water quality. These were published in the water quality act of 1965 and in the so-called anti-degradation statement. The chief index to water quality is temperature with the dissolved oxygen content being the second most important standard. The effect of low flow rates is discussed. The three methods of water quality management programs - (1) stream sampling, (2) sample analyses and (3) data storage, processing and retrieval are discussed in detail. However, problems such as nutrient enrichment and land run-off or natural pollution remain unsolved. (Goodwin-NC State Univ)
W69-08554

FEDERAL ASSISTANCE AVAILABLE TO COMPANIES ESTABLISHING POLLUTION CONTROL PROGRAMS,
Federal Water Pollution Control Administration, Washington, D. C.
W. J. Lacy, and A. Cywin.
Based on a symposium, February 16-18, 1969, sponsored by A.A.T.C.C. and US Departments of Commerce and Interior. Textile Chemist and Colorist, Vol 1 No 7, pp 173/25-176/28, March 26, 1969.

Descriptors: *Water pollution control, *Water Quality Act, *Legislation, Standards, Industrial wastes.
Identifiers: Textile wastes, Industrial grant program.

The history and research and development program of the Federal Water Pollution Control Administration are given. Grant acquisition procedures of federal monies through F.W.P.C.A. are described. Examples of industrial grants made are provided. The nature of textile wastes and the need for treatment of these wastes are discussed. (Livengood-N C State Univ)
W69-08555

BETTER MANAGEMENT OF WATER RESOURCES IS A MUST IF FUTURE NEEDS ARE TO BE MET,
Department of Commerce, Washington, D. C.
K. L. Kollar.
Based on a symposium, February 26-28, 1969, sponsored by A.A.T.C.C. and US Departments of Commerce and Interior. Textile Chemist and Colorist, Vol 1, No 7, pp 173/25-176/28, March 16, 1969.

Descriptors: *Water quality, *Water Resources Planning Act, *Water shortage, *Water resources, Standards, Economics.

A growing population and expanding economy require that water quality control be maintained at a level making multiple reuse possible. Congress has established a Water Resources Council to determine National Water needs and plan development of the Nations' major river basins. Results of Bureau of the Census canvas on the withdrawal and use of water in textile manufacture for 1954, 1959 and 1964 are summarized. Increased concern about water quality by the industry is indicated. (Livengood-N C State Univ)
W69-08557

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

APPLICATION OF COMPUTERIZED OPERATIONS RESEARCH TECHNIQUE FOR OPTIMUM ECONOMIC SIZING OF THE MIDDLE FORK EEL RIVER PROJECT,
California State Dept. of Water Resources. Advanced Techniques Section.
Gary S. Risch.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Int Ass Sci Hydrol, Pub No 80, Vol 1, pp 268-279, 1968. 12 p, 2 fig, 5 tab, 4 ref.

Descriptors: *Operations research, *Systems analysis, Computer programs, Synthetic hydrology, Linear programming, Dynamic programming, Optimization, Economics, Cost-benefit analysis, Reservoir operation, Planning, Streamflow forecasting, Water supply, Water yield.
Identifiers: Eel River (Calif).

The difficulty of the economic analysis of hydrologic projects usually increases exponentially as the number of system components increases. Conventional methods of developing graphs, charts, and curves are being replaced, or at least supplemented, by new operations research techniques such as linear and dynamic programming. These techniques will aid the planner in analyzing hydrologic and economic problems and in providing an optimum economic solution with much less effort than expended using conventional methods. Planning for development of the Eel River, involving 3 potential reservoirs and a connecting tunnel has given us the opportunity to test these new techniques on a medium sized project. This paper illustrates how the computer model could be formulated for both linear and dynamic programming solutions to this sizing problem. Very little knowledge of the linear programming theory is necessary to make use of that technique; however an illustration of the dynamic programming theory is presented to clarify the dynamic programming solution methodology. (Knapp-USGS)
W69-08240

A REVIEW OF SOME APPLICATIONS OF MATHEMATICAL PROGRAMMING TECHNIQUES IN WATER RESOURCES ENGINEERING,
Technion - Israel Inst. of Tech., Haifa. Lowderm Faculty of Agricultural Engineering.
Nathan Buras, and Theodore Herman.
Technion, Israel Inst Tech Progr Rep No 2, July 1968. 131 p, 21 fig, 95 ref.

Descriptors: *Systems analysis, *Optimization, *Water resources development, Water management (Applied), Computers, Computer programs, Dynamic programming, Linear programming, Estimating, Surveys, Management, Operations research, Queueing theory, Optimum development plans, Stochastic processes, Synthetic hydrology, Model studies.
Identifiers: *Water resources engineering, *Israel

The progress of Technion, Israel in using systems analysis in solving water resources development and management problems is discussed. A wide variety of analytical methods were applied in

sign of water resource systems. Most of them, wever, pointed out the necessity of setting up chastic sequential models, as the best approxi-ations to the real situation. Dynamic pro-amming seems to fill this need, with its variations d adaptations. However, the effectiveness of namic programming is limited by the computa-nal difficulties. The conjunctive development d utilization of surface storage and groundwater uifers, especially in semi-arid regions, were suc-sfully analyzed through dynamic programming. ginning with rather simple models, the analysis ogressed to include stochastic inflows serially rrelated, and more specific aquifer-oriented oblems. One such model touched upon the im-rtant problem of optimal exploitation of a astal aquifer, where the salt water-fresh water in-face has an important role. Another model alyzed in great detail the behaviour of an aquifer, ich has to satisfy certain demands for water and ich is connected to the surface storage system through its recharge facilities. Markov ain theory was applied also the derivation of erating rules for multistructure systems, as well to the analysis of problems connected with pollu-n transport in streams. Linearized models of ter resource systems have been used also in the sign and operation of surface reservoirs. (Knapp-SGS)
69-08251

INVENTORY OF PROBLEMS IN WATER ESOURCES ENGINEERING,
chnion - Israel Inst. of Tech., Haifa. Lowdermilk culty of Agricultural Engineering.
than Buras.
chnion, Israel Inst Tech Progr Rep No 1, Oct 67. 42 p, 4 fig, 61 ref.

escriptors: *Systems analysis, *Optimization, Water resources development, Water manage-nt (Applied), Computers, Computer programs, namic programming, Estimating, Surveys, Data llections, Management, Operations research, timum development plants, Stochastic ocesses, Synthetic hydrology.
entifiers: *Water resources engineering, *Israel.

ater resources engineering uses the techniques of stems analysis in solving national water resource oblems. Research in this field in Israel includes a view of the major problems of the engineer, aluation of the operations research techniques eded, and study of the application of dynamic ogramming to analysis of water programs. The oblems of data collection, economic evaluation, ciology, economics, management, urbanization, d operating policy in Israel are outlined and sug-stions for research leading to their solution are ven. (Knapp-USGS)
69-08256

HE ROLE OF UNCERTAINTIES IN THE CONOMIC EVALUATION OF WATER-ESOURCES PROJECTS,
anford Univ., Calif. Dept. of Civil Engineering.
r primary bibliographic entry see Field 06B.
69-08266

EVIEW OF SURFACE WATER SYSTEMS NALYSIS,
ological Survey, Arlington, Va. Water sources Div.
C. Matalas.
oc, Nat Symp Anal Water Resource Syst, p 270-7, Denver, July 1968. 8 p, 20 ref.

escriptors: *Systems analysis, *Design, *Op-ization, *Planning, *Water resources, Simula-n analysis, Economics, Hydrology, Engineering, nthetic hydrology.

e role of systems analysis in the design of optimal ter resource systems was discussed. Previously planning process had been largely in the main of engineering and hydrology. Economics had been treated as an incidental matter to be considered at the end of a project in an effort to justify it. The methodology of systems analysis had been introduced in the past decade and economics had become an integral part, along with engineering and hydrology, of the planning of water resource development. The design of water resource system, be it single or multiple, was subject to alternative plans. The use of benefit-cost analysis, optimization and simulation techniques and of synthetic hydrology for optimal water resource systems planning was considered. (Thiuri-Cornell)
W69-08533

OPERATIONS RESEARCH ACTIVITIES AT CINCINNATI WATER RESEARCH LABORATORY,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Cincinnati Water Research Lab.
For primary bibliographic entry see Field 05D.
W69-08534

AN APPLICATION OF NON-LINEAR PROGRAMMING TO THE PLANNING OF MUNICIPAL WATER SUPPLY SYSTEMS: SOME RESULTS,
Harvard Univ., Cambridge, Mass. Harvard Water Program.
Clifford S. Russell.
Proc, Nat Symp Anal Water Resource Syst, pp 309-314, Denver, July 1968. 5 p, 1 tab, 1 fig, 6 ref.

Descriptors: *Optimization, *Planning, *Municipal water, *Water supply, *Model studies, Timing, Size, Systems analysis, Mathematical models, Interest rate, Economies of scale.
Identifiers: Rules of thumb.

A non-linear programming model was developed and used to analyze water systems for the purpose of generating 'optimal rules of thumb' for the use in the practical planning of Municipal water supply. The analysis included the time path of water system development showing periods of optimality, adequacy and inadequacy, the framework of the model, implications for practical planning, timing and optimal size. It appeared that the optimal size was relatively constant over time when the interest rate was low and/or economies of scale were important, but that the size increased significantly with time when the interest rate was large and economies of scale unimportant. The results obtained pointed to a promising method of harnessing the technique of mathematical programming for the benefit of practical planners. Calculations for the required ranges of key parameters could in principle be done at a central location, and the results made available in the form of size and timing handbook rules. A sample of the handbook tables for optimal rules of thumb was presented. (Thiuri-Cornell)
W69-08535

AN APPLICATION OF LINEAR PROGRAMMING TO EFFICIENCY IN OPERATION OF A SYSTEM OF DAMS,
Raytheon Co., Waltham, Mass.
For primary bibliographic entry see Field 04A.
W69-08536

ESTUARIAL SYSTEMS ANALYSIS QUANTITY AND QUALITY CONSIDERATIONS,
Water Resources Engineers, Inc., Walnut Creek, Calif.
For primary bibliographic entry see Field 02L.
W69-08537

CHINKING UP SOME CRACKS,
Federal Water Pollution Control Administration, Washington, D. C. Div. of Technical Control.
G. K. Young.
Proc, Nat Symp Anal Water Resource Syst, pp 289-297, Denver, July 1968. 9 p, 1 tab, 3 fig, 10 ref.

Descriptors: *Surface water, *Planning, *Pollution abatement, *Dynamic programming, *Monte Carlo Method, *Risks, Computer programs, Control systems, Economics, Water resources, Hydrologic systems, Reservoir operation, River systems, Decision making.
Identifiers: Kanawha River.

Two studies on surface water were discussed. The first discussion provided case study information which compared relative importance of hydrologic uncertainties versus uncertainties in economic and engineering parameters. The second discussion involved computational aspects of the Monte Carlo Dynamic Program for solving reservoir operation problems. For the first study an analysis of pollution control systems on the Kanawha River was made. The Kanawha River study provided the background on the importance of the various phases of the problem. The use of the Monte Carlo Dynamic Programming technique aided in the selection of computational procedures which provided useful information for decision-making on the final commitment of time and money in any systems analysis study. It was concluded that hydrologic uncertainties are less important than other engineering and economic uncertainties. Waste loading and the other engineering and economic factors appeared to contribute greater uncertainty to planning decisions than hydrologic factors. (Thiuri-Cornell)
W69-08539

OPTIMUM OPERATIONS FOR PLANNING OF A COMPLEX WATER RESOURCES SYSTEM,
California Univ., Los Angeles. Water Resources Center.
W. A. Hall, R. W. Shepard, W. S. Butcher, A. M. Esogbue, and S. C. Parikh.
Water Resources Center, Univ. of Calif., Contrib, No 22, p 1-75, October 1967. 75 p, 8 fig, 11 charts, 14 ref.

Descriptors: *Mathematical models, *Dynamic programming, *Linear programming, *Financial feasibility, California, Optimization, Multiple purpose, Economics, Planning, Energy, Reservoirs, River basins, Water resources development.
Identifiers: Sacramento Basin.

A mathematical model for planning optimal operating policy for a deterministic 10-year critical period hydrology was developed and applied to a multipurpose water resource system involving a multireservoir and a multichannel development. The objective of the study was to maximize financial feasibility for planning purposes based on deliveries of firm energy, firm water, off-peak energy and off-season water. The combined water resource projects in the Sacramento Basin were studied. The analysis provided for the specification of the values of firm energy, firm water, dump energy and dump water produced in the critical period and specified for the volume of water to be pumped back for energy storage purposes. The whole system was decomposed into a 'master wholesaler'-'individual producer' relationship. Using dynamic and linear programming techniques the reservoir operators and the master maximize returns, the former for individual reservoir, the latter for the whole system. The analysis emphasized the advantages of system operation as compared to individual project operation. (Thiuri-Cornell)
W69-08540

MATHEMATICAL PROGRAMMING ANALYSIS OF REGIONAL WATER-RESOURCE SYSTEMS,
Battelle-Northwest, Richland, Wash.
James P. Heaney.
Proc, Nat Symp Anal Water Resource Syst, p 231-240, Denver, July 1968. 10 p, 3 fig, 16 ref.

Descriptors: *Resource allocation, *Linear programming, *Dynamic programming, *Optimization, *Constraints, *Regional analysis, Tangible benefits, Intangible benefits, Planning, Basins, Mathematical models.

LIBRARY U. OF L. URBANA-CHAMPAIGN

Identifiers: *The Colorado River Basin.

Linear programming and dynamic programming techniques were applied to the Colorado River Basin to achieve an optimal allocation of its water resources. Both tangible and intangible benefits were considered. It was assumed that the objective function was to maximize regional net benefits subject to the overall regional and individual-study-area constraints. In addition, individual areas sought to maximize their benefits subject to their area constraints. The mathematical programming .nodel developed, offered quantitative techniques for evaluating interdependencies that are of prime concern for regional analysis. It was concluded that the rigid 'requirements' concept ignored the fact that water-resource can be allocated efficiently under competitive economic conditions, and caused water supply systems to be expanded, often at high cost, in order to artificially keep the imputed water value equal to zero. A strong argument for allocating water resources efficiently under competitive economic conditions was provided. (Thiuri-Cornell)
W69-08541

A FIRST TRIAL IN OPTIMAL DESIGN AND OPERATIONS OF A WATER RESOURCE SYSTEM,
Massachusetts Inst. of Tech., Cambridge.
Bruce Blanchard.
Unpublished, Master's, Thesis, Civil Eng, August 1964. 100 p.

Descriptors: *Linear programming, *Optimization, *Design, *River basins, *Hydrologic data, Economics, Simulation analysis, Planning, Water resources, Constraints.
Identifiers: Sensitivity analysis.

A linear programming model was used as a first trial in optimal design of a river basin system. Sensitivity analysis techniques were applied to the linear programming model to examine the effect of errors in hydrologic and economic data and effects of changes in constraints. Results showed that a linear programming model could be used to reduce the number and the range of variables to be used in simulation studies of the basin, as well as, to point out areas of resource allocation in future planning studies. It was found that linear programming (with its considerable limitations) could be an effective technique for a first estimate of the optimal design and operation of a complex water resource system. (Thiuri-Cornell)
W69-08544

STOCHASTIC DYNAMIC PROGRAMMING AND THE ASSESSMENT OF RISK,
Nevada Univ., Reno. Center for Water Resources Research.
William S. Butcher.
Proc, Nat Symp Anal Water Resource Syst, p 315-320, Denver, July 1968. 6 p, 7 ref.

Descriptors: *Stochastic processes, *Risks, *Dynamic programming, *Water resources, *Optimization, Mathematical models, Markov processes, Probability, Decision making, Reservoirs.

The objectives of water resources development, the role that risk plays in choosing these objectives, and the use of stochastic dynamic programming to assess risk in a certain limited number of water resource problems were discussed. Conventional analysis of water resources tended to ignore risk, yet in fact, risk was present and individuals had different assessment of its value placed on expectation of returns. By employing a mathematical model based on the Markov chain technique, the use of stochastic dynamic programming technique for assessing risk and uncertainty involved in making optimal policy decisions was presented. Stochastic dynamic programming is suggested as a means for coming to grips with some of the elements of risk that were not possible to assess by conventional reservoir operation studies. (Thiuri-Cornell)
W69-08546

INDENTIFICATION OF AQUIFER PARAMETERS BY DECOMPOSITION AND MULTILEVEL OPTIMIZATION,
California Univ., Los Angeles. Dept. of Engineering.
For primary bibliographic entry see Field 02F.
W69-08550

6B. Evaluation Process

MISSISSIPPI WATER RESOURCE CONFERENCE - 1969.
Mississippi State Univ., State College. Water Resources Research Inst.
For primary bibliographic entry see Field 02E.
W69-08221

AN INVENTORY OF PROBLEMS IN WATER RESOURCES ENGINEERING,
Technion - Israel Inst. of Tech., Haifa. Lowdermilk Faculty of Agricultural Engineering.
For primary bibliographic entry see Field 06A.
W69-08256

FUTURE WATER SUPPLY OF METROPOLITAN WASHINGTON REGION. REPORT NO 1, REQUIREMENTS AMD SOURCES,
Metropolitan Washington Council of Governments, D. C.
For primary bibliographic entry see Field 06D.
W69-08257

THE ROLE OF UNCERTAINTIES IN THE ECONOMIC EVALUATION OF WATER-RESOURCES PROJECTS,
Stanford Univ., Calif. Dept. of Civil Engineering.
Edward G. Altouney.
Stanford Univ Eng-Econ Proj Rep No EEP-7, Aug 1963. 115 p, 32 fig, 8 tab, 23 ref.

Descriptors: *Cost-benefit analysis, *Project planning, *Risks, *Water resources development, Economics, Management, Statistical methods, Forecasting, PLANNING, Systems analysis.
Identifiers: *Uncertainty analysis.

Estimates of benefits and cost of water resources development are contingent upon numerous assumptions for the future and are subject to uncertainty. Since a single-valued benefit-cost ratio is used as a criterion for determining the economic value of a project and for relative ranking of projects, a measure of the uncertainty of the benefit-cost ratio was found necessary to determine if the funds invested in water projects are truly as productive as claimed. The degree of uncertainty of preliminary cost and benefit estimates was studied to allow the uncertainty of the estimates to be included in the economic evaluation of projects. It was found that cost estimates are undervalued an average of 75% below actual costs, and median cost estimates are undervalued 30% below actual costs, after adjustment of the actual costs for construction price trends, changes in project planning, structural and engineering modifications and national emergency. The undervaluation of costs is even greater before the adjustments. Lognormal distribution functions were found applicable to the ratios of actual to estimated costs and their parameters were computed for the various classes of cost ratios. It was found that the average annual benefits are on the average overestimated. The overestimation was found to increase with the length of the project lifetime and to decrease with the discount rate. A SAMPLE CALCULATION AND Fortran program listing are included. (K-napp-USGS)
W69-08266

NORTH AMERICAN WATER SUPPLY PROBLEMS AND THEIR SOLUTION,
American Bar Association, Chicago, Ill.
Henry P. Caulfield, Jr.
ABA Section of Mineral and Natural Resources Law (1966 Proceedings), p 15-20, 1966. 6p

Descriptors: *Water Resources Planning Act *Water resources development, *River basin commissions, River basin development, Interbasi transfers, Federal government, State governments Local governments, Water quality, Water utiliza tion, Water policy, Administration, Legislation Estimating, Long-term planning, Planning Cooperation, Water allocation (Policy), Wate supply, Water pollution control.
Identifiers: Federal-state cooperation, Wate resources council.

The structure and objectives of the Wate Resources Planning Act are discussed. Title I o the act sets up a Water Resources Council whos functions are to make a national assessment o water conditions, to establish a national pattern o federal water policy, to create federal-state rive basin commissions under Title II and to make 50% grants to the states for comprehensive wate resources planning. Title II establishes federal-stat commissions in order to provide for a collaborativ system of water planning among federal, state an local governments. Such interaction is necessar since each government has separate responsibili ties. The local governments are concerned chiefl with industrial and municipal supply while state are concerned with health and pollution measure The federal government is involved in establishin comprehensive and long-range programs and i aiding with financing and providing technical per sonnel. The commissions are planning bodies wit legislative powers left in Congress and the variou state legislatures. (Kahle-Fla)
W69-08380

SOME IMPORTANT RESEARCH PROBLEM IN THE WATER RESOURCES FIELD,
New Mexico Univ., Albuquerque.
Blair T. Bower.
Natural Resources Journal, Vol 5, No 2, p 286-29 Oct, 1965. 12 p, 6 ref.

Descriptors: *Administration, *Planning, Low flo augmentation, Water quality control, Land us Water supply, Waste disposal.
Identifiers: *Research needs, Accuracy of dat Uncertainty, Institutional aspects.

The article discusses research that will pay off improved water resources planning and manag ment. The first problem is handling uncertaint Three procedures for handling uncertainty a described, all of which emphasize that planni must be carried on continuously. Related to the u certainty problem is the relative accuracy of da used in water resources planning. Planning is insu ficiently related to the precision of the data; studi are needed that relate various levels of precision different types of water resources systems. Instit tional problems are discussed. Techniques need be devised by which the decisions of private a local governmental units can be integrated with t planning and operating decisions of federal a state agencies. There are a range of problems rel ing to development of operating procedures f water resources systems. The author substitut 'water quality improvement' for the less use phrase 'low flow augmentation,' and recommen that water quality improvement benefit functio related to water quality parameters be develope Finally, spatial patterns of land use and wa supply are considered in relationship metropolitan waste disposal facilities. (Gosse Chicago)
W69-08381

RESEARCH ON COMPREHENSIVE PLANNI OF WATER-RESOURCE SYSTEMS,
North Carolina Univ., Chapel Hill
Maynard M. Hufschmidt
Natural Resources Journal, Vol 5, No 2, p 223-2 Oct, 1965. 13 p, 36 ref

Descriptors: *Planning, Technology, Legal aspe Inter-agency cooperation, Alternative co Economic prediction, Input-output analy Systems analysis

ntifiers: *Research needs, Social science, nning regions, Benefit functions.

s paper discusses research needs in comprehen- water-resource planning. Research topics are sented under three headings corresponding to ee major steps of the planning process: (1) ablishing the objectives of design; (2) translating ectives into design criteria; and (3) designing system, through use of the design criteria, for ximum realization of the objectives. Classifying earch in this way emphasizes research problems olving the relationship between social science technology. Two research problems are in- ved in stating objectives. One is to determine ether the federal legislature can express objec- s in forms useful for field-level planners. The ond, involving situations where federal, state, local agencies all participate in planning, is to ify whose objectives are to govern. Translating ectives into criteria involves the following stions: roles of various agencies in deriving ndards and criteria; consideration of alternative t instead of benefits; and definition of ap- priate planning regions. Systems design requires earch on: techniques for regional economic pro- tions; derivation of benefit functions; deriving input-output relationships; preliminary screen- techniques for system design; systems analysis hniques; and the system design process as a ble. (Gossen-Chicago)
9-08382

TURE ECONOMICS RESEARCH ON CSTERN WATER RESOURCES -- WITH PAR- CULAR REFERENCE TO CALIFORNIA,
rth Carolina State Univ., Raleigh.
S. Tolley.
tural Resources Journal, Vol 5, No 2, p 259-285, t, 1965. 35 p, 46 ref.

scriptors: *Economics, California, Water de- nd, Water supply, Water quality, Decision mak- , Legal aspects, Contracts, Input-output analy- Market value, Water costs, Planning, Recrea- n, Pricing, Cost allocation, Water quality con- l.
ntifiers: *Research needs, Water quantity, Pri- ry benefits, Secondary benefits, Economic wth, Feather River project.

ction I discusses the appropriateness of recon- ering the research task in California and pposes a research strategy relating to physical l social sciences. Section II discusses water de- nd and supply and water quality and quantity. research future state and regional economy, ut-output models must be refined, casual analy- of factors influencing growth impetuses is eded, and effect of water availability on regional wth must be determined. Effects of water rges on residential users, public recreation use, iculture, and sensitive industries deserve study. ter supply studies should focus on: emerging hnologies, groundwater, and water quality. Sec- n III discusses estimation of primary and secon- y benefits. Discussion focuses on: planning in w of water demand; recreation and other efits lacking good market indicators; and irr- ersibilities. Section IV discusses economics of ntracts and law. It focuses on: unsettled court is- s; pricing and cost allocation; economic effects legal procedures; and completing the Feather er project. Section V discusses decision-making ocesses. Problems for analysis include: the rela- nship of the state to the federal government, the ects of city growth on water districts, and ar- gements for accomplishing quality control. ossen-Chicago)
9-08383

ONOMIC AND RELATED PROBLEMS IN NTEMPORARY WATER RESOURCES ANAGEMENT,
sources for the Future, Inc., Washington, D. C.
en V. Kneese.
tural Resources Journal, Vol 5, No 2, p 216-258, t 1965. 23 p.

Descriptors: *Administration, Economics, Water allocation (Policy), Water demand, Water costs, Water transfer, Waste disposal, Water quality, Flood control, Navigation, Optimum development plans, Risks, Cost-benefit analysis.
Identifiers: *Research needs, Recreation benefit estimation, Public investment.

The water resource economist-planner faces enormous problems and a lack of researched answers. The rapid urbanization and industrialization of American society; the growth of population and enormous expansion of the economy; and the rapidity of scientific and technological advances have created problems of strong conflicts between uses. Planners must evaluate water services whose market purchase at best generates indirect indications of their value. Projects are called upon not only to meet present and future demands for water but also to stimulate economic growth. Economic research and research on institutional capacities for these complexities is required. After summarizing past contributions of economic theory, the paper defines problems of: water transfer; recreation benefit estimation; waste disposal in water; integrated management of water quality and quantity; use of case studies; evaluation of present and future costs and benefits from public investments; and a method of handling risk and uncertainty. (Gossen-Chicago)
W69-08384

WINDFALL GAINS FROM TRANSFER OF WATER ALLOTMENTS WITHIN THE COLORADO-BIG THOMPSON PROJECT,
Economic Research Service, Washington, D.C.; and Colorado State Univ., Fort Collins.
Raymond L. Anderson.
Land Econ, Vol 43, No 3, p 265-273, Aug 1967. 9 p, 6 ref.

Descriptors: *Legal aspects, *Taxes, Federal Government, Rights.
Identifiers: *Colorado-Big Thompson project, *Windfall gain.

Windfall gains may result when individuals sell water rights that have been developed as a result of governmentally financed water projects. This paper studies the effect upon the use and transfer of the water resources in question if the laws were changed to enable recapture of the unearned increments by the Federal Government through taxation. The Colorado-Big Thompson project is used as a case study to show the basis of the argument for recapture of windfall gains; also, the efficiency gains from the transfer of rights to the available water supply is examined. In conclusion the author states that under the situation that exists within the Colorado-Big Thompson project transfers of water allotments should be allowed even though windfall gains may result. Some of the windfall gains will be recaptured by the government through capital gains tax; also, the community will benefit by the more economically efficient use of the resources. (Grossman-Rutgers)
W69-08385

CONCEPTUAL ISSUES IN THE CONDUCT OF REGIONAL RESEARCH ON THE ECONOMICS OF WATER,
Oregon State Univ., Corvallis. Dept. of Agricultural Economics; and Oregon State Univ., Corvallis. Water Resources Research Inst.
Emery N. Castle.
Agricultural Law Center, College of Law, The University of Iowa, Monograph No 10, p 23-32, Sept. 1968. 10 p, 11 ref.

Descriptors: *Social aspects, *Project planning, Transfer, Water quality.

The paper has four objectives: (1) state in dominant social issues influencing the group management of water in the United States; (2) describe some social problems related to water that are regional in nature; (3) develop some definitions and methodological constructions that are helpful in considering the administration of regional research on water; and (4) discuss the prospects for successful conduct of regional research on the economics of water. Water research stems from specific social problems. More than one discipline is needed to solve special problems. Such a multi-disciplinary approach adds to the complexity of regional research. (Grossman-Rutgers)
W69-08386

REGIONAL ECONOMIC DEVELOPMENT AND WATER,
State Univ. of Iowa, Iowa City. Dept. of Economics.
Wilbur R. Maki.
Agricultural Law Center, College of Law, The University of Iowa, Monograph No 10, p 84-104, Sept 1968. 21 p, 2 fig, 5 tab, 17 ref.

Descriptors: *Water resources development, *Growth stages, Spatial distribution, *Regional analysis.
Identifiers: Infrastructure, Population density.

There are four policy issues relevant to water resource development: (1) identifying viable development planning regions; (2) establishing nodal points for stimulating regional growth; (3) achieving rural-urban balance; and (4) facilitating regional planning and community development. A region's water resources are related to its economic development. Economic areas of low population densities are contrasted with areas of high densities. Each area has its own particular problems. The four stages of regional growth are identified. Regions and subregions are delineated and export producing activities, spatial linkages, and regional organization are considered. A section on improving regional economic structures is included. It discusses industry mix and regional share and infrastructure and amenities. Also discussed is how to establish resource development priorities. (Grossman-Rutgers)
W69-08387

WATER RESOURCE DEVELOPMENT: PUBLIC AND PRIVATE INVESTMENT,
Michigan State Univ., East Lansing. Dept of Agricultural Economics; and Michigan State Univ., East Lansing. Dept. of Resources Development.
Allan A. Schmid.
Agricultural Law Center, College of Law, The University of Iowa, Monograph No 10, p 61-78, Sept 1968. 18 p, 29 ref.

Descriptors: *Investment, Economic efficiency, Interest rate, Return (Monetary).
Identifiers: *Nonmarginal economic analysis.

The article discusses some problems of nonmarginal economic analysis; thus, the focus is on investments which fundamentally change the kind of inputs available and involve major changes in output choice. Also discussed are the choice of interest rate, the surplus crop question, and choice of investment criteria. Furthermore, investment involving public funds is linked with other institutional controls affecting resource use. The distributive issue of efficiency versus other values is examined. The uniqueness of water and public investment is also examined. In conclusion, the author states that the real problem is determining the proper mix of investments and how the returns of one investment affects the returns of the other. (Grossman-Rutgers)
W69-08388

REGIONAL RESEARCH IN WATER IN THE NORTH CENTRAL REGION,
South Dakota State Univ., Brookings. Dept. of Economics; and Economic Research Service, Brookings, S. Dak.
Gordon D. Rose, and Dean T. Massey.
Agricultural Law Center, College of Law, The University of Iowa, Monograph No 1, p 1-19, Sept 1968. 19 p, 2 append, 32 ref.

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Descriptors: *Water law, *Economic justification, *Project planning, Water resources development.
Identifiers: *North Central Region, *North Central Research Project NC-57.

The focus of the monograph is on legal-economic regional research concerned with investigating problems regarding the use, allocation, and development of water resources. This article re-examines legal and economic regional water resources research in the North Central Region. First, the organizational structure for regional research is examined. Second, the history and accomplishments of the North Central Region Research Project NC-57 are discussed. Finally, present research efforts are evaluated, and suggestions for future research are made. The summary states that current activities could be conducted equally well without a regional project. Therefore, modification of the present method of conducting regional research is needed. Two selected bibliographies are included. (Grossman-Rutgers)
W69-08391
Florida Univ., Gainesville. Inst. of Food and Agricultural Sciences.
John E. Reynolds, and Gary C. Jones.
Report-Institute of Food and Agricultural Sciences, The University of Florida, Pub No 3, Dec 1967. 116 p.

Descriptors: *Resource development, Project planning, Water pollution, Recreation, Optimum development plans.
Identifiers: *Southeast U.S.

This report contains the papers presented at a workshop on water research needs. The objectives of the workshop were: (1) to delineate economic research needs on problems of water resource development; (2) to identify and appraise alternative analytical procedures with respect to their usefulness in analyzing water resource problems; and (3) to stimulate and guide economic research on water resource problems. The following topics of significance are covered: The importance of research and planning in water resource development, the current federal program for river basin planning and the need for economic analysis, economics in water research, water-oriented outdoor recreation, economics of water pollution, optimization methods in water resources planning, and water resource economics research in the Southeast. (Grossman-Rutgers)
W69-08392

OPPORTUNITIES FOR REGIONAL RESEARCH ON WATER RESOURCES PROBLEMS,
Iowa Univ., Iowa City. Coll. of Law.
Dean T. Massey, and Gordon D. Rose.
Overall entry. Agricultural Law Center, College of Law, The University of Iowa, Monograph No 10, Sept 1968. 142 p, 1 append.

Descriptors: *Organizations, *Project planning, Water demand, Water supply, Water quality control, Data storage and retrieval.
Identifiers: *North Central Region.

This monograph is a report of a seminar on water resources. The seminar had the following purposes: (1) To assess viable opportunities for regional research on water resources in the North Central States; (2) to furnish a basis for improvement of regional water research; and (3) to lay a foundation for a long term program of regional research on water. Specifically, the report covers regional research in water in the North Central Region, conceptual issues in the conduct of regional research on the economics of water, regional and national planning of agricultural research, water allocation, water resource development, regional economic development and water and data systems and information retrieval adaptable to water resources. A short discussion paper follows each article. (Grossman-Rutgers)
W69-08393

AN ECOLOGICAL AND RECREATIONAL USE SURVEY OF THE LUXAPALILA RIVER,
Mississippi State Univ., State College. Dept. of Wildlife Management.
For primary bibliographic entry see Field 06G.
W69-08399

A PROPOSED PARTNERSHIP COMPACT FOR OUR NATION'S RIVER,
Alvin C. Watson.
Journal of Soil and Water Conservation, Vol 24, No 3, p 89-94, May-June 1969. 6 p, 5 ref.

Descriptors: *River basin development, *Interstate compacts, *Interstate commissions, *Water resources development, Water conservation, Flood protection, Water pollution control, Water utilization, State governments, Project purposes, Planning, Long range planning, Projects, Administrative agencies, Water management (Applied), Administration, Basins, Federal government, Programs.
Identifiers: *Potomac River Basin.

Several of the reasons for attempting to set up an interstate-federal compact agency for the Potomac are: (1) the multiplicity of jurisdictions involved in water problems with a splintering of responsibilities, both compounded by a lack of coordination; (2) the studies that have set forth action programs which were never instigated; and (3) the need for comprehensive planning for water resources management. Problems of water supply, flood control and pollution have been focused on because of the Potomac's proximity to Washington. Recommendations from the President and the Corps of Engineers led a meeting of governors to appoint an advisory committee to set up the framework for a basin wide agency. That committee's proposal for a state-federal compact is outlined in detail. The most important role of the commission is to mobilize existing water resource agencies to perform their maximum responsibilities. The proposed interstate-federal compact would provide a mechanism for continuous planning and management of the basin's water resources. (Douberly-Fla)
W69-08487

A TEST OF THE HYPOTHESIS THAT POLLUTION CONTROL IS WORTH WHAT IT COSTS,
Delaware Univ., Newark. Urban Affairs Div.
For primary bibliographic entry see Field 05D.
W69-08542

ECONOMIC EVALUATION OF RESERVOIR SYSTEM ACCOMPLISHMENTS,
Corps of Engineers, Sacramento, Calif. Hydrologic Engineering Center.
Leo R. Beard.
Proc, Nat Symp Anal Water Resource Syst, p 278-288, Denver, July 1968. 11 p, 2 tab, 4 fig.

Descriptors: *Economics, *Computer programs, *Systems analysis, *Hydrologic properties, *Optimization, *Water resources, Reservoirs, Planning, Design, Evaluation.

Procedures of a comprehensive computer program that performed an elaborate hydrologic analysis of a system of reservoirs and assigned economic values to the output were described. The objective of the study was to lay a foundation for obtaining objective functions that expressed the socio-economic effects of a system, to provide intermediate hydrologic and economic data and a method of basing the actual design and operation of a hydrologic system on theoretical optimization techniques. The computer program described performed an elaborate and detailed sequential analysis of almost any configuration of water resource projects. System characteristics and requirements could be specified in any desired degree or detail with minimum effort. Output included detailed data on the month to month operation, as well as hydrologic and economic summaries useful for rapid evaluation of system performance. (Thiur Cornell)
W69-08543

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

WATER-FRONT INPROVEMENTS.
For primary bibliographic entry see Field 06E.
W69-08180

DESALINATION-POWER PLANT PROVE ECONOMICALLY FEASIBLE,
Kaiser Engineers, Oakland, Calif.
For primary bibliographic entry see Field 03A.
W69-08295

WATER RESOURCE DEVELOPMENT: PUBLI AND PRIVATE INVESTMENT,
Michigan State Univ., East Lansing. Dept Agricultural Economics; and Michigan State Univ East Lansing. Dept. of Resources Development.
For primary bibliographic entry see Field 06B.
W69-08388

OPTIMAL TAXING FOR THE ABATEMENT O WATER POLLUTION,
Carnegie-Mellon Univ., Pittsburgh, Pa.
For primary bibliographic entry see Field 05F.
W69-08547

THE ECONOMICS OF CLEAN WATER,
Scott Paper Co., Philadelphia, Pa.
For primary bibliographic entry see Field 05F.
W69-08548

THE AVAILABILITY OF QUALITY WATER I IMPORTANT IN PICKING A PLANT SITE,
Lockwood Greene Engineers, Inc., Spartanburg, S C.
For primary bibliographic entry see Field 05G.
W69-08553

6D. Water Demand

FUTURE WATER SUPPLY O METROPOLITAN WASHINGTON REGIO REPORT NO 1, REQUIREMENTS AM SOURCES,
Metropolitan Washington Council of Govern ments, D. C.
Richard Hazen, Thomas M. Niles, Roy H. Ritter, and Abel Wolman.
Available from the Clearinghouse as PB 177 50 for $3.00 paper copies and 65 cents in microfich Metrop Wash Counc Governments, Board of Er Rep No 1, May 1967. 70 p, 7 fig, 14 tab.

Descriptors: *Water demand, *Water suppl *Water sources, *District of Columbia, *Urbaniz tion, Municipal water, Industrial water, Plannin Forecasting, Dams, Reservoirs, Streamflow, Riv basin development.
Identifiers: Washington DC Metropolitan are Potomac River.

The Washington Metropolitan Region is co sidered to encompass an area of 3,000 sq mi, i cluding the District of Columbia and adjacent citi and counties on both sides of the Potomac Rive The population of the region is expected to i crease from 2.6 million at present to 4.2 million b 1985 and 6.1 million by 2010. Average dry ye water demands will grow from 320 mgd supplied b major systems in 1966 to 670 mgd in 1985 and 1050 mgd by 2010. Of the total 110 to 150 m probably will be drawn from local sources oth than the Potomac River. Peak daily demands drought years will exceed average requirements approximately 80 per cent. The water needed fro

Potomac River or other non-local sources will rage 560 mgd and 900 mgd in 2010. Maximum ith requirements will be 728 mgd in 1985 and 0 mgd in 2010. Maximum day demands will be mgd in 1985 and 1620 mgd in 2010. The un-ilated Potomac River cannot be depended upon more than 374 mgd which barely supplied the er used in 1966, when some water restrictions e enforced. Increasing water demands and rring major drought conditions will require re curtailment of water use unless additional endable supply is provided as quickly as possi-(Knapp-USGS)
9-08257

TER ALLOCATION: SUPPLY AND DE-ND RELATIONSHIPS,
e Univ. of Iowa, Iowa City. Dept. of nomics.
n F. Timmons.
icultural Law Center, College of Law, The versity of Iowa, Monograph No 10, p 44-56, t 1968. 13 p, 1 tab, 15 ref.

criptors: *Demand, *Water quality, *Water ply, Pricing, Water values.

regard to water resource research the author nsiders the following concepts: (1) mythology niqueness and shortages imputed to water, (2) ctity of present allocative devices, (3) alloca- and/or development, and (4) homogeneous il-ons of water supplies and demands. Approxima-s of demands for and supplies of water are dif-ntiated into three groups: (1) qualities linked n demands by amounts and qualities linked with plies by amounts, (2) spatial occurrences of lity linked supplies and of quality linked de-nds, and (3) temporal occurrences of quality ed supplies and quality linked demands. Two damental characteristics of the supply of and nand for water insofar as quality is concerned : (1) quality heterogeneity of water supplies, (2) quality differentiation demand according ses. Allocation alternatives for prospective sup-s and demands are examined. Also discussed is identification of supply-demand water use enti-, and the development of water use firms ntified by water use entities. (Grossman-Rut-s)
9-08390

ATER USE AND RELATED COSTS WITH OLING TOWERS,
ois State Water Survey, Urbana, Ill.
primary bibliographic entry see Field 05G.
9-08407

C. Water Law and Institutions

ATER POLLUTION CONTROL.
primary bibliographic entry see Field 05G.
9-08127

VER AND HARBOR IMPROVEMENT.

USCA secs 591, 594, 601 (1957).

scriptors: *Condemnation, *Compensation, ondemnation value, *Mississippi River, Rivers Harbors Act, Federal government, Federal ject policy, Administrative agencies, United tes, Water resources development, Legislation, gal aspects, Easements, Reservoirs, Right-of-y, Regulation, Appropriation, Administrative isions, Land tenure, Public benefits.
ntifiers: Secretary of the Army, Penalties iminal), Improvements.

Secretary of the Army may institute proper al proceedings for the acquisition by condemna-n of any land, right-of-way or material needed to ntain or prosecute works for the improvement rivers and harbors. When the owner of such d, right-of-way or material fixes a price for the same, which is reasonable to the secretary, he may purchase the same at that price. The secretary may accept donations of lands or materials. Whenever the secretary institutes such condemnation proceedings, the United States shall have the right to take immediate possession of lands, easements or rights-of-way, provided that just compensation shall have been made to those people entitled thereto. The secretary shall prescribe such rules and regulations regarding the use and administration of reservoirs at the headwaters of the Mississippi River as he judges the public interest and necessity require. Such rules shall be made public information. Any person knowingly violating such rules shall be subject to a fine or imprisonment. (Carruthers-Fla)
W69-08128

WATER CONSERVATION AND IRRIGATION CORPORATION.

Ala Code tit 12 secs 280-297 (1959).

Descriptors: *Alabama, *Water conservation, *Irrigation, Irrigation programs, Irrigation practices, Local governments, Legislation, Wells, Water supply, Flood control, Multiple-purpose projects, Municipal water, Industrial water, Eminent domain, Financial analysis, Cost allocation, Costs, Construction, Projects, Permits, Public benefits, Impoundments, Administrative agencies, Construction costs.
Identifiers: Water conservation and irrigation corporation.

The governing body of any county can declare the need for a water conservation and irrigation corporation. The contents and requisites of the certificate of incorporation, mode of its filing, and details regarding the board of directors and officers of the corporation are set forth. Such corporation shall have the power to: (1) provide a water supply by stream impoundment or wells, (2) develop and operate an irrigation project, (3) provide for flood control, (4) provide for multiple purpose developments, (5) enter into agreements and contracts with agencies of the federal government. Detailed procedures are outlined for the obtaining of permits for construction projects. The duties of the director of the department of conservation are included. Bonding and other financing matters necessary for the operation of such corporations are set forth. All counties, cities, towns and other political subdivisions are authorized to lease or convey real property to the corporation. Construction awards will be based on sealed bids and publicly advertized. Authorized agents and employees of the corporation shall have a right of entry on land, water and other premises to make surveys, drillings and examinations. Such corporations shall be exempt from all taxation in the state of Alabama. (Carruthers-Fla)
W69-08129

FLOOD CONTROL AND SOIL CONSERVATION.
For primary bibliographic entry see Field 04A.
W69-08130

KEEP MAINE SCENIC; ALLAGASH RIVER AUTHORITY.

Me Rev Stat Ann tit 12, secs 631-633, 661-680 (Supp 1968-69).

Descriptors: *Maine, *Habitat improvement, *Shelterbelts, *Wildlife management, Watershed management, River basin commissions, Soil conservation, Wildlife conservation, Legislation, Scenery, Aesthetics, Conservation, Recreation, Scenic easements.
Identifiers: Wilderness areas.

The Maine State Park and Recreation Commission is to maintain a continuing keep Maine Scenic Program. A 12 member advisory committee to advise and consult with the State Park and Recreation Commission to carry out a general program for the elimination of litter along Maine's roadsides, beaches, and waterways is provided for. The Allagash River Authority and Wilderness Waterway is created to preserve and develop the state's waterways and wilderness recreational areas, and to prevent erosion, droughts, freshets and the filling up of waters. The Authority has the power to acquire land, water and power rights by purchase, rental or eminent domain. The Authority may also establish rules and regulations for the effective governance of the waterway and impose fines and imprisonment for their violation. The Act provides for a restricted zone of from 400-800 feet of the waterway to protect and develop its maximum wilderness character. The use of power driven watercraft along the waterway is forbidden and the building or expansion of structures within the restricted zone, except with Authority approval, is to be prevented. Existing sporting camps are to be bought by the Authority and leased back to the owners on terms and conditions imposed by the Authority. (Blunt-Fla)
W69-08131

WESTERN AND ATLANTIC RAILROAD V HASSLER (DAMAGES CAUSED BY INADEQUATE CULVERT).

92 Ga App 278, 88 SE 2d 559-565 (1955).

Descriptors: *Georgia, *Flood Damage, *Precipitation excess, *Rainfall intensity, Judicial decisions, Damages, Rainfall, Precipitation, Railroads, Culverts, Rainfall Disposition, Excessive precipitation, Runoff, Drainage, Surface runoff, Floods, Cloudbursts, Streams, Nonnavigable waters, Mills, Riparian land, Culverts, Drainage, Natural flow.
Identifiers: Act of God, Negligence.

Plaintiff owned a mill adjacent to a non-navigable creek. The creek flowed through a culvert under defendant's tracks approximately two thousand feet from the mill. The culvert was adequate in area to take care of the normal flow of the creek. The defendant raised its tracks two and one-half feet, and reinforced the culvert by adding several inches of new masonry, thereby reducing the flow of water through the culvert by about fifteen percent. The raising of the tracks prevented the overflow of the water in time of heavy rains. During such rains, plaintiff's mill and cotton gin were damaged because of flooding. The question presented was whether damage resulted from an act of God or through the fault of the railroad. The court held that this was a question for the jury. If the flood that did occur was so extraordinary and unprecedented that it could not have been foreseen and the damage could not have been prevented by prudential means, the railroad could not be held liable. (Heckerling-Fla)
W69-08132

THOMAS V LACOTTS (REASONABLE USE OF RIPARIAN WATERS).

257 SW 2d 936-941 (Ark 1953).

Descriptors: *Arkansas, *Riparian rights, *Alteration of flow, *Reasonable use, Pumping, Natural use, Legal aspects, Judicial decisions, Obstruction to flow, Pumps, Underground streams, Farms, Hunting, Surveys, Streams, Bayous, Water shortage, Damages, Dams, Land tenure, Riparian land, Boundaries (Property).
Identifiers: Evidence.

Plaintiff's property is separated from defendant's land by a meandering stream. Defendant dammed the stream at a point immediately before it entered the plaintiff's property. Plaintiff contended that the dam interferred with his riparian rights and lowered the underground water level causing plaintiff additional expenses in pumping. The court held that a riparian owner is entitled to the unimpaired natural

flow of a stream over his land, but this right is subject to reasonable uses by upper proprietors. Under the riparian doctrine, no proprietor has priority in the use of water in derogation or another's rights. The damages assessed by the Chancellor were affirmed. (Shevin-Fla)
W69-08133

UNITED STATES V STATE OF LOUISIANA (LOUISIANA BOUNDARY CASE).

89 S Ct 773-817, (1969).

Descriptors: *Federal-state water rights conflicts, *State governments, *Boundary disputes, *Boundaries (Surfaces), Legal aspects, Jurisdiction, Earth-water interfaces, Interfaces, Water law, Boundary processes, Political aspects, Federal government, Federal jurisdiction, Judicial decisions, Legislation, State jurisdiction, Water rights.

Plaintiff asks for a declaration that it is entitled to exclusive possession of and power over lands under the Gulf of Mexico which are more than three geographical miles from the coast. A previous case construing the Submerged Lands Act of 1953 held that the United States was entitled to submerged lands seaward of the three mile limit. Both parties ask for a supplementary decree designating actual boundaries. Such determination requires interpretation of the phrase 'the line marking the seaward limit of inland waters' from the prior case. That line must be drawn in accordance with the definitions of the Convention on the Territorial Sea and the Contiguous Zone. Consideration in construing such definitions is given to islands and their relationships to the mainland, their size, distance from mainland, depth and utility of intervening waters, shape of island, and relationship to configuration or curvature of the coast. The choice under the convention to use the straight base line method for determining inland waters against other nations rests with the federal government and not with the states. A special master was appointed to determine the actual boundaries by means consistent with this opinion. (Johnson-Fla)
W69-08134

CITY OF NEW YORK V BROOKLYN BOROUGH GAS CO (PUBLIC UTILITIES RIGHT TO NAVIGABLE STREAM).
105 NYS 2d 459-473 (SC 1951).

Descriptors: *New York, *Public utilities, *Ownership of beds, *Navigable waters, Streambeds, Gases, Bridge construction, Pipelines, Public rights, Easements, Proprietary power, Grants, Prescriptive rights, Access routes, Roads, Relative rights, Projects, Safety, Riparian rights.
Identifiers: *Obstruction to navigation, *Nuisance (Public), Highway commissions.

The city brought suit to enjoin a gas company from maintaining a bridge and certain gas pipelines which were attached to the bridge and laid in the bed of a navigable stream. Defendant asserted that plaintiff, as successor in interest to the town, did not get absolute ownership of the creek bed since the town's highway commissioners had granted to defendant the right to do all things necessary to supply gas to the town. This impliedly gave defendant the right to use the creek bed as gas-pipe access route. Moreover, defendant alleged that the bridge was constructed pursuant to recommendations by a department of plaintiff-city. The court declared that this authorization was made on the condition that the federal government consent because the creek was a navigable stream. Any bridge construction without such permission did not give defendant the right to continue to use the bridge. The court ruled that since defendant failed to show the highway commissioners' power to grant the right to use the creek bed, such right could not be created by implication, especially where an obstruction of a navigable waterway would be caused thereby. The court concluded that defendant must remove the pipes and bridges at its own expense because defendant's right to exercise its franchise was subject to regulation when public safety required. (Reed-Fla)
W69-08135

MINNESOTA-WISCONSIN BOUNDARY COMPACT (PURPOSE AND INTENT).

Minn Stat Ann sec 1.31 (1967), as amended, (Supp 1968).

Descriptors: *Minnesota, *Interstate compacts, *Interstate commissions, Federal government, Legislation, Soil conservation, Soil erosion, Agriculture, Dams, Navigation, Water pollution, Recreation, Fish, Wildlife conservation, Water resources development, Water policy, Planning.

Minnesota agrees: to cooperate with other states party to this compact in establishing a boundary area commission; to consider the commission's recommendations with respect to regional planning for boundary areas and; to consider measures for controlling air and water pollution, programs for erosion control; diversion of waters from and into the rivers, and restrictions of land use to preserve recreation in river basins. The commission shall consist of five commissioners from each state with the powers and duties to make recommendations and correlate studies of the federal government and other agencies. No recommendation, plan or finding of the commission shall have the force of law or be binding upon any state agency. Studies may be made for determining the most beneficial plans for: regional development, navigation, dams, agriculture, fish and wildlife, recreation, commerce, pollution, other beneficial purposes. The commission is to be financed by donations and state appropriations. Each state reserves the right to withdraw from the compact at any time. (Kahle-Fla)
W69-08136

AIRCRAFT; UNDERGROUND GAS STORAGE.
Minn Stat Ann secs 84.49 to 84.53 (1964), as amended, (Supp 1964).

Descriptors: *Minnesota, *Aircraft, *Boats, *Zoning, Administrative agencies, Legislation, Boating, Transportation, Airports, Regulation, Permits, Legal aspects.
Identifiers: Penalties (Criminal).

No aircraft pilot, owner or operator shall keep any watercraft at certain designated wilderness areas except at private property with a residence thereon. Any watercraft kept or maintained in such a way so as to violate these provisions shall be subject to confiscation, as contraband, and any violation shall be a misdemeanor. (Helwig-Fla)
W69-08137

UNDERGROUND GAS STORAGE.

Minn Stat Ann sec 84.57 (1964), as amended, (Supp 1968).

Descriptors: *Gases, *Underground storage, *Permits, *Subsurface waters, Administrative agencies, Legal aspects, Underground streams, Pressure, Legislation, State governments, Local governments, Cities, Relative rights.
Identifiers: Penalties (Criminal).

It shall be unlawful for the state or any person or any political subdivision to displace any underground waters by the underground storage of gas or liquid under pressure without a permit from the Commissioner of Conservation. (Helwig-Fla)
W69-08138

REFORESTATION, AFFORESTATION AND FLOOD CONTROL PROJECTS.

Minn Stat Ann secs 84A.21, 84A.22, 84A.27 to 84A.30 (1947).

Descriptors: *Minnesota, *Forests, *Flood contr
*Forest management, Forest fires, Forestry, La
use, Eminent domain, Administrative agenci
Conservation, Supervisory control (Powers), R
forestation, Wildlife, Lakes, Streams, Loc
governments, Land, Legislation, Projects, Manag
ment, Wildlife conservation, Recreation, Regu
tion, Water management (Applied), Permits, Hu
ing, Natural resources, Appropriation, Le
aspects.
Identifiers: Afforestation, Penalties (Civil).

Certain reforestation and flood control proje
shall be under the control and management of t
Department of Conservation. The Department
authorized to make rules for: the care of forests;
forestation and afforestation; regulation of t
waters of meandering lakes and flowing strea
prevention of forest fires; and the sale of timber.
addition, the department is empowered to regula
wildlife and recreational activities. All land, priva
and public, within the projects shall be subject
these rules. All money received in connection wi
any project shall be credited to said project in t
state treasury and shall be appropriated for the pu
poses thereof. Lands certified to be suitable for
forestation or water control shall be acquired
the state for such purposes. The Department
authorized to accept gifts of land or personalty
any project which it deems suitable for such pu
poses. The Department has the authority to acqui
land by the right of eminent domain for any su
project. Violators of any rule pertaining to any pr
ject shall be guilty of a misdemeanor. (Helwig-Fla
W69-08139

CLEVELAND BOAT SERVICE V CITY C CLEVELAND (CONDEMNATION VALUE C ACCRETED LAND).

130 NE 2d 421-430 (Ohio Ct App 1955).

Descriptors: *Ohio, *Condemnation, *Ripari
land, *Lake Erie, Navigable waters, Lake shor
Judicial decisions, Boundaries (Property), Lan
fills, Land tenure, Condemnation value, Damag
Competing uses, Accretion (Legal aspects), Bou
daries (Property), Legal aspects, Water law.
Identifiers: *Littoral proprietorship, *Public tru
doctrine.

In a lower court lessee recovered a $50,000 judg
ment for damages against the city of Cleveland, t
condemnor. The basis of the suit was interferen
by the city with leased realty along the shoreline
Lake Erie by constructing a freeway on part
plaintiff-lessee's leasehold adjacent to the La
Erie shoreline. On appeal by the condemnor
questions of law, the Ohio Court of Appe
reversed and remanded. In the lower court, co
demnor was not allowed to introduce evidence th
the lease purported to cover land formed by filli
in the waters of Lake Erie beyond the natu
shoreline. The upper court held that this evident
ry exclusion constituted prejudicial error since,
condemnor's allegation were true, the title to t
shoreline over which this dispute arose wou
repose in the state of Ohio as trustee for the peo
and any lease executed pertaining to such la
would be void ab initio. The littoral rights of pla
tiff under such circumstances would be subject
regulation and control by the state and fede
governments. (Carruthers-Fla)
W69-08140

GAME AND FISH.

Minn Stat. Ann secs 97.40 to 97.57 (1957).

Descriptors: *Minnesota, *Wildlife, *Conser
tion, *Fishing, Hunting, Animals, Legislation, Fi
Wildlife management, Administrative agenci
Natural resources, Permits, Regulation, Pub
lands, State governments, Legal aspects, La
management, Mussels, Eminent domain, Fish c
servation, Wildlife conservation, Land resourc
Water law.

state shall have ownership, control and the
onsibility of wild animals, fish and aquatic
tation in the state. The Commissioner of Con-
ation shall have the authority to regulate the
g, possession, transportation, storage and
osition of protected game and fish within the
. The commissioner shall have broad powers
wildlife conservation, fishing, control of rough
interstate conservation agreements, mussels
animal propogation. The commissioner may
ire land for conservation, public hunting and
eational purposes. The commissioner may
gnate experimental waters and regulate activi-
le shall serve warrants and make arrests for of-
es relating to conservation. He shall have
ers to search for, confiscate and dispose of il-
ly taken wildlife. Penalties shall be authorized
imposed for violations of this law. (Helwig-Fla)
-08141

**SESSION AND TRANSPORTATION OF
TECTED GAME AND FISH.**
n Stat Ann secs 97.40 to 97.47 (1957).

criptors: *Minnesota, *Wildlife, *Conserva-
, *Wildlife management, Animals, Fish, Fur-
ers, Beavers, Muskrats, Hunting, Fishing,
mals, Legislation, Administrative agencies,
ral resources, Wildlife conservation, Permits,
l aspects, Regulation, Fish management.
tifiers: Protected animals, Tanners.

ownership of wild animals and aquatic vegeta-
in public waters is in the state. No one shall
or possess any wild animals except as per-
ed by law and during open season. No one shall
protected wild animals in commercial cold
ge. Protected wild animals may be disposed of
ft subject to restriction. Mounted animals and
are excepted from this section. Tanners shall
ll beaver and muskrat hides in their possession.
person may transport in open season, within or
out the state, any protected animal which may
awfully sold. Fish lawfully taken, may be car-
by a resident or transported by common carri-
consigned to himself. A licensed non-resident
transport a restricted amount of dressed or un-
sed fish within or without the state or may
y his legal limit lawfully taken anywhere. All
tainers of fish shall be clearly marked for
tification. Minnows shall not be transported
ide the state. Confiscation of any part of a ship-
t as contraband shall extend to the entire ship-
t. No person shall waste any usable part of pro-
ed wild animals. (Helwig-Fla)
-08142

**WERS AND DUTIES OF THE COMMIS-
NER OF CONSERVATION.**

n Stat Ann secs 97.48, 97.481 (1957).

criptors: *Minnesota, *Administrative agen-
, *Conservation, Fishing, Hunting, Wildlife
agement, Hatcheries, Recreation, Interstate
pacts, Regulation, Wetlands, Marshes, Legisla-
, Legal aspects, Wild rice, Deer, Fish conserva-
, Water conservation, Experimental farms,
d management, Land resources.

Commissioner of Conservation is empowered
reduce seasons or limits on wildlife to reduce
letion and promote propagation; enter con-
ts with certain other states to remove rough fish
n boundary waters; regulate fishing and hunting
oundary and international waters; take and
ose of rough fish from state waters; close areas
he taking of mussels or minnows; preserve
rable wildlife; destroy undesirable wildlife;
y on a wildlife breeding and stocking program;
uire property for game farms, hatcheries, hunt-
grounds, game preserves and recreational
s; protect fish in shallow or receding waters;
ulate wild rice production; promote conserva-
among civic groups; issue permits for taking
les or frogs by light; regulate hunting seasons;
ulate deer hunting in small hunting refuges to
promote safety; pose certain land under his jurisdiction as wildlife management areas; designate certain lakes as experimental waters and regulate activity thereon; and acquire and develop wetlands in the interests of water conservation to the end of wildlife conservation or recreation. (Helwig-Fla)
W69-08143

POLICE POWER AND DUTIES OF THE COMMISSIONER OF CONSERVATION.
Minn Stat Ann secs 97.50, 97.501, 97.55 to 97.57 (1957).

Descriptors: *Minnesota, *Conservation, *Regulation, *Wildlife, Water law, Wildlife conservation, Permits, Dams, State governments, Administrative agencies, Water pollution, Drainage, Jurisdiction, Legal aspects, Legislation, Beavers, Fishing, Hunting, Public lands.
Identifiers: *Police power, Penal statutes.

The Department of Conservation shall not stock any waters to which the public is denied free access. The Commissioner of Conservation shall grant to anyone taking rough fish under permit the right to sell such fish to any person. The commissioner may sell rough fish taken by fishermen under contract with the state. Moneys received from licenses, fines, sale of contraband, and reimbursements to the department shall be credited to a game and fish fund to be used for related purposes. The commissioner and his agents are empowered to serve all warrants for violations relating to wild animals, use and protection of water, conservation, dams and water pollution. They may arrest persons violating conservation laws. They may search and inspect certain premises and items for contraband and may confiscate game illegally taken and items used in the taking. The commissioner may enter into reciprocal agreements with the United States and other states for interjurisdictional appointment of game wardens. The department may remove any beaver dam interfering with proper drainage. (Helwig-Fla)
W69-08144

MINERAL LANDS AND LEASES.

Minn Stat Ann secs 93.01, 93.05 to 93.13, 93.34 to 93.355.

Descriptors: *Minnesota, *Mining, *Mineral industry, *Permits, Leases, Mining engineering, State governments, Mineralogy, Navigable waters, Lakes, Beds, Exploration, Exploitation, Drainage, Condemnation, Easements, Right-of-way, Ownership of beds, Streambeds, Water law, Riparian rights, Legislation, Legal aspects, Hydroelectric power, Contracts, Royalties.

The state reserves for its own use all valuable minerals and all water powers in land belonging to it. The holder of any mineral permit or lease in land may enter thereon and prospect. Before entry on the land any permit holder shall pay the land owner security for any damages. Upon request of any permit holder, the attorney general may initiate proceedings to condemn land in connection with any prospecting. All minerals under navigable lakes belong to the state. The Department of Conservation shall adopt regulations for the issuance of permits to mine beneath public waters. The holder of a mineral lease shall have the right to mine within the area covered by the lease. Anyone failing to comply with the terms of a lease shall forfeit such lease. Certain lakes may be drained and the iron ore removed from the bed. No one shall mine or drain a public lake without authority. The Commissioner of Conservation may sell mining permits for the beds of public waters. The holder of a permit may obtain a mineral lease and pay a royalty thereon to the state. (Helwig-Fla)
W69-08145

BOARD OF COUNTY COMMISSIONERS V PATE (FORFEITURE OF ILLEGAL FISHING DEVICES).
221 So 2d 732-734 (Fla 1969).

Descriptors: *Florida, *Fish conservation, *Fishing devices, Fishing, Boats, Legislation, Legal aspects, Judicial decisions, Sport fish, Recreation, Water sports, Conservation, Boating, Sport fishing, Regulation, Fish.
Identifiers: *Forfeiture, Penalties (Civil).

The Florida Supreme Court quashed consolidated cases of the Florida Second District Court of Appeal which construed the phrase 'net, traps or fishing devices' in Fla Stat sec 372.31 as excluding boats and motors used directly and on the water in poaching operations. The court held that the district court decisions were in direct conflict with the Florida Supreme Court case of Bruce v Malloy, 150 Fla 157, 7 So 2d 123 (1942) which construed an earlier version of Fla stat sec 372.31 as allowing forfeiture and disposal of boats and motors, and accordingly quashed and remanded the consolidated decisions of the district court. Justice Boyd dissented a length contending that Bruce v Malloy did not rule on the question of whether boats and motors were included in the forfeiture provisions of the statute and that the legislative history regarding revisions of the statute revealed an intent to exclude boats and motors from its coverage. (Carruthers-Fla)
W69-08146

PATUXENT RIVER WATERSHED.

MD Ann Code art 66C secs 411A thru 411U (1957).

Descriptors: *Maryland, *Watersheds (Basins), *Flood protection, *Watershed management, Conservation, Local governments, Legislation, Planning, Regulation, Land management, Costs, Taxes, Public benefits, Docks, Recreation, Roads, Beaches, Forests, Forest management, Parks, Erosion, Leases.
Identifiers: *Patuxent River, Misdemeanors, State agencies.

Counties in which a portion of the Patuxent River watershed is located, in cooperation with each other and the Department of Forests and Parks, are authorized to acquire land and adopt a watershed plan for the purpose of instituting a program of conservation and flood prevention. The plan shall include the proposed location and uses for such lands. After public hearing, the plan may be adopted by a majority vote of the county commissioners. The commissioners may make regulations for the use of the land, violations of which are deemed misdemeanors. The lands may be leased by the counties to private persons for periods not exceeding 20 years and for uses not inconsistent with the plan. Funds for acquisition of land may be obtained by donation, appropriation by the state or federal government, or by special taxes imposed by the county in conjunction with 50% matching funds from the Department of Forests and Parks. (Kahle-Fla)
W69-08147

PATUXENT RIVER WATERSHED.

MD Ann Code Art 66C secs 411A through 411 K (1957).

Descriptors: *Maryland, *Watershed management, *Local governments, Flood protection, Erosion, Legislation, Planning, Watersheds (Basins), Lland management, Public benefits, Docks, Roads, Beaches, Recreation, Cost, Leases, Conservation.
Identifiers: Patuxent River.

Howard, Montgomery, Prince George's, Anne Arundel, Calvert, Charles and St. Mary's counties, acting jointly and with the Department of Forests and Parks are authorized to define the Patuxent

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River watershed in their counties for the purpose of protecting the watershed by a program of flood prevention and conservation. Each county may adopt and amend a watershed plan of recommendations for the protection of the watershed. Such plan shall include the location and proposed uses of lands to be acquired and the locations of roads, waterways, waterfronts, beaches, docks, parks, forest preserves, wildlife refuges and recreational areas. Before adopting or amending the plan the county must hold a public hearing, after 30 days notice, with the majority of the county commissioners voting in favor of the resolution. Each county may acquire and develop land (either within or without the county) necessary to carry out the plan. Land acquisition may be financed by donations or appropriations from the United States, the state of Maryland, or private persons. The counties may lease such lands or grant concessions to individuals for periods not exceeding 20 years and for purposes not inconsistent with the watershed plan. (Kahle-Fla)
W69-08148

PATUXENT RIVER WATERSHED.

MD Ann Code Art 66C secs 411 L through 411 U (1957).

Descriptors: *Maryland, *Watershed management, *Flood protection, *Land management, Erosion, Conservation, Planning, Regulation, Legislation, Watersheds (Basins), Taxes, Costs, Forest management, Parks, Forests, Local governments, Administrative agencies, Regulation.
Identifiers: *State agencies, Misdemeanors.

The county commissioners may make rules and regulations for the use of land acquired under this subtitle. These rules and regulations shall be posted on the lands and published in local newspapers. Violations of the regulations are deemed misdemeanors punishable by fine and/or imprisonment. The Department of Forest and Parks shall include requests for funds to be used for acquisition of lands in its annual budget. Such funds are to be matched by the county acquiring the land. The Department shall cooperate with the counties in formulating a Patuxent River watershed plan, and in acquiring land. The counties are authorized to levy an annual special tax upon all property in the county, the proceeds of which shall be used for the acquisition of land under the watershed plan. (Kahle-Fla)
W69-08149

WATERSHED PROTECTION AND FLOOD PREVENTION.
For primary bibliographic entry see Field 04A.
W69-08150

NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMPACT.
For primary bibliographic entry see Field 05G.
W69-08151

DRAINAGE DISTRICTS UNDER 1911 ACT.
For primary bibliographic entry see Field 04A.
W69-08152

ACQUISITION OF A CERTAIN DAM AND WATER RIGHTS.

NH Rev Stat Ann secs 482-A:1 thru 482-B:3 (1968).

Descriptors: *New Hampshire, *Administrative agencies, *Dams, Taxes, Repairing, Rehabilitation, Water control, Public benefits, Water resources development, Dam construction, Water rights, Legislation.
Identifiers: *Acquisition, Mirror Lake dam, Buck Street dam.

For the consideration of one dollar, the New Hampshire Water Resources Board is authorized to acquire from the owners thereof the Mirror Lake and Buck Street dams, the water rights, and lands used in connection with these dams. The acquisitions are made for the purpose of improving and controlling certain water rights for benefit of the state. The New Hampshire water resources board is authorized to make repairs and modifications after acquisition of the property. The properties are exempt from taxation while held by the state. (Gadd-Fla)
W69-08153

SEWAGE DISPOSAL SYSTEMS NEAR SHORELINES.
For primary bibliographic entry see Field 05E.
W69-08154

LOCAL PROVISIONS.
For primary bibliographic entry see Field 05G.
W69-08155

WATER SKIS, SURFBOARDS AND AQUAPLANES; REGATTAS, ETC.

SC Code Ann secs 70-295.51 thru 70-295.56 (1962), as amended, (Supp 1968).

Descriptors: *Surfboarding, *Recreation, *South Carolina, *Waterskiing, Boats, Legislation, Regulation, Permits, Safety, Equipment, State jurisdiction, Federal jurisdiction.
Identifiers: Regattas.

A motorboat towing a person on water skis or similar device must either have an observer in addition to the operator or be equipped with a rear view mirror. Water-skiing and surfboarding are prohibited between one hour after sunset and one hour before sunrise. Skis or surfboards shall not be operated so as to collide with any object or person. Persons, other than performers in tournaments, must wear life belts while on skis or surfboards. Regattas or exhibitions may be authorized upon application made 15 days in advance. The date, time and location of the event shall be set forth. Nothing herein shall be construed as creating an exemption from federal regulation, but no state permit need be acquired if a permit has been granted from a federal authority. (Kahle-Fla)
W69-08156

WATERS AND WATERCOURSES: NORTH CAROLINA LINE TO WINYAH BAY.

SC Code Ann secs 70-281 thru 70-287 (1962).

Descriptors: *South Carolina, *Inland waterways, *Condemnation, *Right-of-way, Surveys, Eminent domain, Compensation, Damages, United States, Administrative agencies, Legislation, State jurisdiction, Federal jurisdiction, State governments, Land tenure, Land reclamation, Financing, Costs, Monetary benefits, Beds under water.
Identifiers: Compensation offset.

The state may grant land to the United States to aid construction of the inland waterway by the United States from the North Carolina-South Carolina border to Winyah Bay. The width of right-of-ways shall vary between 1000 and 1750 feet, depending upon the elevation above sea level. Lands previously submerged which are raised by excavation deposits shall become the property of the United States. Lands privately owned by any person or corporation or condemned by an political subdivision of the state may be acquired by the State Development Board and be deeded to the United States for purposes of this article. The Board may obtain a right-of-way by condemnation if unable to secure it otherwise. Benefits to the owner of such land shall be offset against any compensation awarded. The United States may condemn lands at state expense. In condemnation proceedings the uses under this act are paramount to all ot public uses. To determine which lands are nece ry under this article, the Board or the United St may enter and survey and no claim shall a against them because of such entry. The s retains concurrent civil and criminal jurisdict over the lands acquired under this article. (Har Fla)
W69-08157

LANDOWNERS IN YORK COUNTY TO CLE OUT STREAMS.

SC Code Ann secs 70-201 thru 70-204 (1962) amended, (Supp 1968).

Descriptors: *South Carolina, *Streamflow, *C struction to flow, *Land tenure, Legislati Streams, Natural flow, Local governments, Re tive rights, Cost repayment, Costs, Engineers e mates, Boundaries.
Identifiers: *York County, Notice, Townships.

All landowners and their agents in York Cou shall, between July 5 and August 15, clear all structions and debris that obstruct the natural f of running streams on their lands. The govern body of the county may extend the time for cle ing due to illness or other necessity. The govern body shall give annual notice by mail between J 1 and July 10 to each owner or his agent of requirement of this act. The township comm sioners shall inspect all running streams in th townships between August 15 and August 20. T shall then notify the governing body of the cou of all delinquents by August 25, and supply an e mate of the cost of cleaning the delinquer stream. The county shall then clean the stream a pay for it from the county fund. The expense sh be a first lien on the delinquent's property, wh may be sold and title made in the same manner a real estate foreclosure. (Harris-Fla)
W69-08158

LANDOWNERS IN CHESTER AND CHEROK COUNTIES TO CLEAN OUT STREAMS.

SC Code Ann secs 70-191 thru 70-196 (1962) amended, (Supp 1968).

Descriptors: *South Carolina, *Streamflow, *C struction to flow, *Natural flow, Debris, Legi tion, Local government, Regulation, Bounda (Property), Control, Costs, Cost repayment, La tenure, Relative rights, Natural streams, Financi
Identifiers: *Chester County, *Cherokee Cou *Stream cleaning, Notice.

Between July 10 and July 15 of each year, Ches and Cherokee County landowners shall remove obstructions to natural flow of running streams or bounding their land. Upon just grounds the ti may be extended by the governing body of county. Published notice of the requirement sh be given in each county, and personal notice s be given to each owner along a stream u request of two or more such owners. After persc notice, if any landowner refuses or neglects clean a stream, the county shall procure estima and clean the stream upon advancement of nec sary funds by persons interested in cleaning stream. The cost shall be a first lien on the land the delinquent owner, and shall be filed as in case of a mechanic's lien. If the delinquent downer refuses or neglects to pay, the lien may foreclosed as is a real estate mortgage. C recovered by foreclosure shall be paid to the p advancing funds or cleaning the stream. The art is supplementary to other laws for cleaning stre and does not repeal them. (Harris-Fla)
W69-08159

SAVANNAH RIVER NAVIGATION COMM SION.

SC Code Ann secs 70-51 thru 70-49 (1962) amended, (Supp 1968).

criptors: *South Carolina, *Navigable rivers, ministrative agencies, *Condemnation, eral jurisdiction, State jurisdiction, United es, Channels, Navigable waters, Costs, Road truction, Bridges, Easements, Flow, Federal- water rights conflicts, Legislation, Salaries, struction, Navigation.
tifiers: *Flowage rights, *Savannah River gation Commission, State Highway Depart- t, Civil and criminal process.

governor shall appoint 5 citizens as members ne Savannah River Navigation Commission to the United States in construction and main- nce of channels in the Savannah River below usta, Georgia. The members shall be appointed serve terms, without compensation, as pro- d in this chapter. A majority may act at a duly d meeting. From the upper limits of Savannah ior, Georgia to the upper limits of Augusta, rgia, the commission may represent local in- sts in dealing with the United States. The State way Department shall cooperate by changing ways, bridges, and approaches necessary for gation improvements. The commission may by hase, condemnation, donation, or otherwise re land, flowage rights or easements required ne United States, and the state shall not be lia- for expenses incurred. After acquisition, the etary of State shall convey any rights to the ed States. The United States may also con- n lands under federal statutes and with com- ion cooperation. Condemnation for purposes is chapter shall take priority over condemna- by other companies or agencies. The state ns concurrent jurisdiction with the United es over any land acquired and held under this ter in order that civil or criminal process shall inue to issue on those premises. (Harris-Fla)
-08160

LIMINARY PROVISIONS.

Code Ann tit 7, secs 4101-4104 (1953), as nded, (Supp 1966).

criptors: *Delaware, *Drainage districts, od protection, *Conservation, Drainage ems, Drainage programs, Legislation, Adminis- ve agencies, Soil conservation, Wildlife conser- on, Water conservation, Soil conservation, lic benefits, Public health.

declared that drainage and prevention of flood- of low or swampy lands is a public benefit and ducive to public health safety and welfare. The ose of this chapter is to provide a basis for a orm system of establishing drainage organiza- s under the supervision of the State Soil Con- ation Commission in order to conserve soil, r, wildlife, forests and other resources. The s 'benefits', 'landowners', 'taxable', and inage' are defined. Any landowners served by a iously established drainage organization or desire to have their lands drained or protected flooding may petition for the establishment of ax Ditch pursuant to the provisions of this ter. Assets and liabilities of existing drainage nizations may be transferred to the Tax Ditch. drainage organization shall be established or ganized except under this chapter. Existing or- zations shall be governed by the laws under ch they were organized unless they reorganize er this chapter. (Kahle-Fla)
-08161

KING OYSTERS FROM CERTAIN WATERS.
Code Ann tit 7, secs 2131-2134 (Supp 1966).

criptors: *Delaware, *Commercial shellfish, sters, *Regulation, Legislation, Legal aspects, er policy, Commercial fishing, Shellfish, Indus- , Marine fisheries, Control, Fish harvest, Fish agement, Water rights, Rivers, Tributaries.
tifiers: Limits, Seed oysters, Shellfish harvest.

h the exception of taking oysters for planting poses, no oysters may be taken from Broadkiln River of less than three inches in length and no boat may exceed twenty-five bushels of such legal oysters in a single day's catch. No oysters may be taken from the Mispillion or Murderkill Rivers until October 1, 1959, and then no more than fifteen bushels per day per boat. The annual season for taking oysters in these rivers extends from October 1 to March 31, inclusive. No seed oysters may be taken from the Mispillion or Murderkill Rivers or their tributaries. (Johnson-Fla)
W69-08162

CONSERVATION.

Del Code Ann tit 7, secs 2301-2306 (Supp 1966).

Descriptors: *Delaware, *Crabs, *Clams, Regulation, Conservation, Fish conservation, Legislation, Permits, Dredging, Boats, State jurisdiction, Seasonal, Rivers, Bays, Fishing, Commercial fishing, Fishing gear.

No person shall sell or possess any crabs with eggs visible thereon or from which the egg pouch has been removed. Any US citizen may take hard shell crabs greater than four inches in length without a license; provided non-residents may not use more than four hand lines nor take more than 50 crabs per day. Crabs taken from the Indian River or Rehoboth Bay may not be sold. Possession of more than one bushel of hard shell crabs, other than peeler crabs, less than 5 1/2 inches is prohibited. Soft shell crabs less than 3 1/2 inches, and peeler crabs less than 3 inches, may not be taken or sold. Boats using a dredge to take crabs must be licensed for that purpose and must have been owned by a resident for at least one year or have been built within that time and have been owned continuously by a resident. A license must be obtained to take crabs in pots. Licenses will be reissued to residents who have lost a licensed vessel through accident. Crabs may not be taken by dredge from March 16 to December 15. Clams may not be taken in Rehoboth Bay or Indian River by dredge or any mechanical device. (Kahle-Fla)
W69-08163

POSSESSION OF CERTAIN MARINE LIFE.
Del Code Ann tit 7, sec 1202 (Supp 1966).

Descriptors: *Delaware, *Commercial fishing, *Regulation, *Fish management, Legislation, Legal aspects, Fish, Marine fish, Fish conservation, Fisheries, Water policy.
Identifiers: *Marlin, *Sailfish, Marine game fish, Possession, Penalties (Criminal).

Atlantic sailfish, blue marlin, white marlin and striped marlin may not be possessed by any person with intent to sell nor may they be sold, purchased, delivered for shipment, or shipped from or within this state. Clearly marked and unbroken packages coming from other states or counties, showing the true origin and destination beyond the limits of this state are excepted from the above restrictions. Persons violating this section may be fined or imprisoned. (Johnson-Fla)
W69-08164

HIGHWAYS (USE OF LANDS UNDER DELAWARE RIVER).

Del Code Ann tit 17, sec 408, 409 (Supp 1966).

Descriptors: *Delaware, *Delaware River, *River beds, *Bridge construction, Public utilities, Legislation, Administrative agencies, State governments, Beds under water, Land use, Public lands.
Identifiers: *Delaware Memorial Bridge.

The state of Delaware consents to the use by the division of highways of all lands lying under the waters of the Delaware River which are within the state and are deemed necessary for the construction of the Delaware Memorial Bridge. (Gadd-Fla)
W69-08165

STATE BOARD OF HEALTH: WATER.
For primary bibliographic entry see Field 05G.
W69-08166

FLOOD CONTROL PROJECTS.

NH Rev Stat Ann secs 481-A:1, 481-B:1 thru 481-B:3, 481-A:1 (481-C:1) thru 481-A:3 (481-C:3) (1968).

Descriptors: *New Haaampshire, *Administrative agencies, *Water control, *Water policy, Dams, Water allocation (Policy), Water distribution (Applied), Legislation, Legal aspects, Water law, Project planning, Administration, Federal project policy, Federal government, Local governments, Management, Water rights, Appropriation, Riparian rights, Repairing, Flood control.
Identifiers: *Water Resources Board.

The Water Resources Board may cooperate with the federal government under provisions of the Federal Flood Control Act of 1936 in the development of the Beaver Brook Flood Control Project. In order to carry out this project, the board may acquire necessary interests in land, arrange for relocation of highways and utility lines, and enter such other agreements with the city of Keene or the federal government. The board is authorized to accept conveyances of certain lands and water rights along the Contoocook River and the Salmon Falls River for the purpose of improving and controlling such water rights for the benefit of the state. The board is also authorized to acquire certain listed dams and to repair and modify them in the best interests of the state. (Johnson-Fla)
W69-08167

SEASONS, WATERS, LIMITS.

Vt Stat Ann tit 10, secs 121-122 (Supp 1968).

Descriptors: *Vermont, *Fishing, *Regulation, *Fish types, Seasonal, Trout, Bass, Pikes, Perches, Salmon, Lakes, Ponds, Rivers, Fish conservation, Fish management, Legislation.
Identifiers: Pickerel, Smelt.

Certain listed lakes and ponds are designated as closed waters for all fishing except during the open season for trout. Except for certain tributaries of the Connecticut River and of Lake Champlain, all streams are closed trout waters except during the open season. The open season, minimum size limits, catch limits, and waters are listed for trout, salmon, pike perch, black bass, pickerel, and smelt. (Kahle-Fla)
W69-08168

PROPAGATION AND CONTROL OF FISH AND WILD ANIMALS.

Vt Stat Ann tit 10, secs 4134, 4136-4140 (Supp 1968).

Descriptors: *Vermont, *Wildlife, *Conservation, *Reproduction, Fish reproduction, Breeding, Fish hatcheries, Wildlife conservation, Weirs, Animals, Water pollution, Ecology, Fishing, Mammals, Natural resources, Wildlife management, Fish management, Spawning, Legislation, Water law, Administrative agencies.
Identifiers: Fishways.

The Commissioner of Conservation shall have charge of the propagation and distribution of fish and wildlife. He shall provide for the operation of game farms, hatcheries, fishways and weirs. He may introduce fish into closed waters. He may transport fish and wildlife for the artificial propagation thereof for scientific and land management purposes. The commissioner may permit the taking of any harmful fish or wild animal. He may control aquatic vegetation and life in public waters. Any temporary pollution shall be done only upon notice to and in accordance with procedures of the State Water Resources Board. By agreement with the

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owners thereof, the commissioner may close any private, noneboatable waters. Such waters while closed shall not be included in private preserves or propogation farms. During the spawning season of any fish species, the commissioner may close portions of waters used for spawning. Waters, except closed waters, stocked by the commissioner, shall be treated as public waters. The commissioner may designate certain waters as test waters to secure data on the propagation of fish. Such waters shall be posted, notice given of such use and regulated by the commissioner. (Helwig-Fla)
W69-08169

AUTHORIZATION, CONSTRUCTION AND MAINTENANCE OF BRIDGES.
For primary bibliographic entry see Field 08A.
W69-08170

SUITS FOR INJURIES ON HIGHWAY.

SC Code Ann sec 33-921, 33-922, 33-925 (1962).

Descriptors: *South Carolina, *Accidents, *Bridges, *Highways, Damages, Legislation, Road construction, Bridge failure, Regulation, Legal aspects, Boats.
Identifiers: Counties, Causeway, Ferries, Negligence, Tort liability.

Any person receiving injury through a defect or negligent repair of a highway causeway or bridge or of a ferry operated by the county, occasioned by the neglect of a county, may collect damages if he were in no way guilty of contributory negligence. If death is caused by such a defect, the right of action for such injury and death shall survive to and may be enforced by the personal representative of the deceased. If it appears that the county had written notice of the defect before the accident occurred, then the burden of proof shall be on the county to show (1) that the defect did not in fact exist (2) that it had been properly repaired of (3) that a reasonable time in which to make repairs had not elapsed since such notice was received. (Shevin-Fla)
W69-08171

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO V UNITED STATES STEEL CORPORATION (INDUSTRIAL WATER POLLUTION).
For primary bibliographic entry see Field 05G.
W69-08172

SEINES, TRAPS, OBSTRUCTIONS IN STREAMS, ETC GENERALLY.

SC Code Ann secs 28-607 thru 28-656 (1962), as amended, (Supp 1968).

Descriptors: *South Carolina, *Fish conservation, *Fishing, *Fish migration, Fish management, Nets, Fish ladders, Fish passages, Reasonable use, Dams, Legislation, Legal aspects, Water law, Sport fishing, Fish harvest, Sport fish, Water utilization, Regulation, Zoning, Control, Sluices, Water rights, Water sports, Recreation, Fishing gear, Local governments.
Identifiers: Penalties (Criminal).

Nets, traps, and other devices may be used to catch nongame fish in muddy inland waters. Such devices shall not be used from Saturday evening to Wednesday morning to take such fish. Special fishing regulations are set forth applicable to the respective game zones into which the state is divided. Other regulations deal with specific bodies of water. Most of these deal with the regulation of the use of certain fishing devices. For example, it is unlawful to take fish in game zone no. 1 by use of seines, and sport fishing there with rod and reel is regulated. Where seines are allowed, special regulations govern mesh size, length, etc. Game fish caught in nets must be immediately returned to the water from whence they came. No permanent obstruction, save dams for manufacturing purposes, may be placed in any waters of the state so as to obstruct free migration of fish. Dams on navigable streams must provide a fishway or ladder so that migratory fish may ascend upstream. The governing body of each county must designate the fish sluices on rivers so as to promote fish migration. There are seasons established for taking nongame fish in certain game zones. (Johnson-Fla)
W69-08173

ETKIN V HYNEY (LEGAL CONSTRUCTION OF RESTRICTIVE COVENANT).

299 NYS2d 862-864 (1969).

Descriptors: *New York, *Reasonable use, *Recreation, Lake shores, Land use, Recreation facilities, Water law, Judicial decisions, Legal aspects, Leases, Swimming, Boating, Shores, Islands, Land tenure, Riparian rights.
Identifiers: Restrictive convenants, Injunctions, Picnicking.

Defendant conveyed to plaintiff lands along a lakeshore upon which plaintiff constructed a dwelling. Defendant retained title to adjacent properties including a small island. In her conveyance to plaintiff, defendant restricted the use of the property to private residential uses only. Later, defendant constructed, on property nearby, six summer cottages and began to construct a road to permit access of her tenants to the lake shore and the island. The tenants and defendant's family used the island for picnicking, swimming and boating. Plaintiff sought to enjoin construction of the road and such use of the island, contending that these activities violated the restrictive covenant. The trial term held for defendant and the appellate division of the Supreme Court affirmed holding that the acts alleged were not inconsistent with the 'private residential uses' stipulated in the deed. (Carruthers-Fla)
W69-08174

RELATIONS WITH FEDERAL GOVERNMENT; CERTAIN STATE-OWNED LANDS.

SC Code Ann secs 28-41 thru 28-47 (1962).

Descriptors: *South Carolina, *Federal government, *State governments, Administrative agencies, Recreation, Hunting, Fishing, Wildlife, Wildlife conservation, Wildlife management, Projects, Regulation, Land, Forests, Forestry, Forest management, National forests, Navigable waters, Game birds, Fish, United States.
Identifiers: Santee-Cooper area.

Congress is given consent to make all rules deemed necessary by the Federal Government regarding birds, animals and fish on lands in South Carolina purchased by the United States under a certain congressional act of March 1, 1911. The South Carolina Wildlife Resources Department may enter into a cooperative agreement with the Federal Government for the protection of wildlife resources of the national forest lands within the state. The Director of the Division of Game may close all hunting and fishing within such lands for such period of time as he deems necessary. The director may also prescribe hunting and fishing seasons and fees for licenses therefore and other such rules. Any person violating the rules so promulgated shall be subject to fine or imprisonment. These provisions shall apply also to other properties of the Federal Government and any other properties acquired therefrom by this state. Hunting and fishing is not allowed on lands controlled by the State Commission of Forestry, except by written agreement therewith. Funds collected on the Santee-Cooper area shall be used solely for game and fish protection in that area. The state assents to the act of Congress providing aid for wildlife projects. (Carruthers-Fla)
W69-08175

CAPITAL CANDY CO INC V CITY OF MONTPELIER (FLOOD DAMAGE FROM DRAINAGE SYSTEM).

249 A2d 644-646 (Vt 1968).

Descriptors: *Vermont, *Flood damage, *Storm drains, *Cities, Damages, Drainage, Floods, Appropriation, Eminent domain, Judicial decisions, Legal aspects, Competing uses, Relative rights, Surface drainage, Drainage water, Storm drainage, Storm runoff, Sewers, Drainage effects, Drainage practices, Watersheds (Basins), Preferences (Water rights), Public benefits, Public rights, Condemnation.
Identifiers: *Trespass, Negligence, Contributory negligence.

The plaintiff corporation brought an action for flood damage to warehouse merchandise as a result of defendant city changing its storm sewer system on adjacent land. The court affirmed a judgment for the plaintiff holding there was sufficient evidence that the city had caused the damage. The flooding of private land in the operation of municipal storm sewage system constituted appropriation of the land. The city was liable for this unlawful invasion of property. The fact that the drainage may have related to a public function did not excuse the neglectful trespass. The plaintiff had a right to improve and use his leasehold as it saw fit in spite of the probability of overflow. Plaintiff must have foreseen the damage with certainty to constitute contributory negligence on his part. (Breeze-Fla)
W69-08176

BROWN V CITY OF JOLIET.

247 NE2d 47-52 (Ill App Ct 1969).

Descriptors: *Illinois, *Surface drainage, *Storm drains, *Cities, Planning, Judicial decision, Land use, Regulation, Drainage programs, Administrative agencies, Legal aspects, Project planning, Sewers, Surface runoff.
Identifiers: City of Joliet, Illinois, Subdivision plat, Planning commission.

Brown, a subdivision developer, sued to require the city of Joliet, Illinois to record her subdivision plat. Her plat had been down by the city planning commission and subsequently the city council because they felt she had failed to include adequate plan for surface runoff. The planning commission felt that development without adequate provision for storm drains would increase drainage problems in adjacent areas and would not drain her own development properly. Brown claimed that the requirement of more adequate provision for surface runoff was an illegal confiscation of her property. Judgment was entered for the city. The city had authority to make regulations for adequate water drainage before recording of a plat. There was a presumption of validity of these ordinances. There was sufficient evidence to show that Brown had not made adequate provision for surface drainage and that the city had acted properly under the ordinances. Brown was not deprived of property unconstitutionally as the problem required the city to be remedied was a product of her own specific and unique activity. The problem was not one of the general community which the city is trying to force her to remedy at her own expense. (Gadd-Fla)
W69-08177

MUNICIPAL PUBLIC WORKS.
For primary bibliographic entry see Field 04A.
W69-08178

PUBLIC WORKS AUTHORIZED UNDER ARTICLE.
For primary bibliographic entry see Field 04A.
W69-08179

TER-FRONT INPROVEMENTS.

Code Ann secs 59-561 thru 59-564 (1962).

criptors: *South Carolina, *Navigable waters, ores, *Condemnation, Legislation, Legal ects, Cities, Tidal waters, Compensation, nent domain, Excavation, Condemnation e, City planning, Shore protection, Dredging, lands, Land reclamation, Riparian rights, lic rights, Public benefits, Area redevelopment. ntifiers: Nontidal waters.

city with a population of at least 50,000 may uire all private property necessary to extend, rove, or protect its water front on a navigable am, tidal or nontidal. This improvement must or a public purpose. Sections 25-161 to 25-170 ern the acquisition procedure including just pensation. This right to acquisition includes right to condemn. If the city desires to fill lands by excavating from the stream bed, the s be a lien upon the land of the private owner. ity must give notice of the proposed filling to n private owner who may then fill the land at his expense. If the owner objects to the cost of the ng, he may require the city to purchase the lot at agreed price. If the parties cannot agree on a e, the city shall condemn the lot. (Breeze-Fla)
9-08180

GHTHOUSES AND OTHER AIDS TO VIGATION.

Code Ann secs 39-71, 39-72 (1962).

criptors: *South Carolina, *Lighthouses, deral-state water rights conflicts, *Jurisdiction, igable waters, Navigation, Riparian rights, ter policy, Ships, Buoys, Federal government, te governments, Legislation, Legal aspects, nership of beds, Beds under water, Federal juiction, State jurisdiction.
ntifiers: *Aids to navigation.

governor may convey title to the US for state l covered by US navigable waters as the spective site of some aid to navigation. An norized US agent must make application and no le tract shall contain more than ten acres. The ernor may also cede jurisdiction over the tract, the state shall retain concurrent jurisdiction for ice of process. (Breeze-Fla)
9-08181

ECIFIC GRANTS OR CESSIONS.

Code Ann secs 39-108, 39-109, 39-117, 39-118 62).

criptors: *South Carolina, *Submerged lands, vigation, *Riparian land, Riparian waters, d development, Legislation, Legal aspects, ter policy, Political aspects, Land use, Federal ernment, Navigable waters, Boundaries (Proty), Ownership of beds, Navigable rivers, Militaspects, Coastal plains, Marshes, Tidal marshes, dies of water, Dredging, Channel improvement.

arge section of specifically described marshland ch may be used to facilitate the improvement of nd navigation and which may be dredged, cut, d, occupied and used at the direction of the Detment of Defense or Congress, is granted to the ted States. Another similar grant along Archer's ek is made to facilitate improvements of navigan along the length of said creek. In Charleston nty, certain lands including certain submerged ds near Cooper River, lands near Noisette ek, and lands bounding the United States navy d are ceded to the United States. Jurisdiction r these submerged lands in all cases not affectthe real and personal property of the United tes remains with the state. Permission is given to posit material dredged from certain of these ds as a result of channel improvements upon adning marshlands outside these grants. Such grants are subject to any prior legal interests and rights of any person and the lands heretofore mentioned are free from taxes. (Johnson-Fla)
W69-08182

TRESPASSING ON PRIVATE DOCKS.
SC Code Ann secs 54-431 thru 54-434 (Supp 1968).

Descriptors: *South Carolina, *Docks, *Land tenure, *Regulation, Public rights, Permits, Legislation, Federal government, State governments, Administrative agencies, Bodies of water, Jurisdiction.
Identifiers: *Trespass, Notice, Private rights, Criminal penalties.

Trespassing or attaching a boat or other device to any privately owned dock on public or private waters shall be a misdemeanor, provided the owner has posted a conspicuously placed notice worded 'trespassing on this dock is prohibited by law.' This act does not apply to docking facilities open to the general public or private facilities used in emergencies, with implied or expressed permission of the owner, or in the performance of duties arising out of state or federal charters, licenses or franchises. This chapter shall not prevent or interfere with the right of any person, governmental body, commission or agency to regulate and control activities on waters and adjoining lands under their jurisdiction. (Harris-Fla)
W69-08183

ARKANSAS STATE HIGHWAY COMM V CARRUTHERS (DAMAGES IN EMINENT DOMAIN PROCEEDING).

439 SW2d 40-41 (Ark 1969).

Descriptors: *Arkansas, *Eminent domain, *Compensation, *Highway construction, Cost repayment, Condemnation value, Judicial decisions, Bridge construction, Land tenure, Damages, Leases, Access routes.
Identifiers: *Evidence.

The Arkansas State Highway Commission brought an eminent domain proceeding against appellees for the acquisition of lands needed for highway construction. On trial, the jury returned a $45,000 verdict in favor of appellees. At the trial the landowners testified to the estimated cost of constructing a bridge to provide access to a portion of their land after the taking. Appellee's witnesses also testified to damages to an airstrip which they were leasing. Appellant alleged error in the admission of this evidence. On appeal the Supreme Court of Arkansas held that the owner's testimony of a contractor's estimate was heresay and not expert testimony. The court also held when property is under lease at the time of the condemnation, the owner's damages are confined to the reversion--not the leasehold estate. (Harris-Fla)
W69-08184

ROCKEFELLER V HOGUE (REMOVAL OF GAME AND FISH COMMISSIONERS).

439 SW2d 805-813 (Ark 1969).

Descriptors: *Arkansas, *State governments, *Administrative agencies, *Adjudication procedure, Administration, Governments, Judicial decisions, Jurisdiction, Legal aspects, Decision making, Political aspects, Personnel management.
Identifiers: State constitutions, Injunctions.

The governor of the state sought to remove two members of the Game and Fish Commission. He appointed a panel to hear the charges and to present the record to him. The commissioners obtained an injunction in the Chancery Court enjoining the hearing and the governor appealed. The commissioners had been appointed pursuant to the state constitution which also provided for their removal from office by the governor after a hearing. The hearing was subject to review by the Chancery Court and appeal to the state Supreme Court. The court interpreted this provision of the constitution to mean a commissioner removed by the governor was entitled to a new trial on the merits without regard to any error in proceedings before the governor. The court held that the commissioners had a full and adequate remedy at law and the Chancery Court was without jurisdiction to issue the injunction. There are two concurring opinions. (Helwig-Fla)
W69-08185

STATE BOARD OF HEALTH, FOOD PROCESSING LAWS, WATER SUPPLY.

17 SC Code Ann 190 (1962).

Descriptors: *South Carolina, *Potable water, *Industrial water, *Water quality control, Water storage, Storage tanks, Water supply, Public health, Water pollution, Water requirements, Legislation, Corrosion, Administrative agencies.
Identifiers: *State Board of Health, *Food processing, Water quantities.

Water meeting all requirements of the State Board of Health as to drinking water shall be easily accessible to all parts of food processing rooms. Any industrial water used at a processing plant shall have no connection with potable water used for food manufacturing. Non-potable water shall not be piped into food processing rooms. The water accessible should be of sanitary quality to avoid contamination of food and equipment. The water shall also be supplied in sufficient quantities to complete all cleaning necessary. Water storage tanks should be corrosion resistent, and protected from contamination. (Harris-Fla)
W69-08186

STATE BOARD OF HEALTH, RAILROADS, WATER AND ICE SUPPLIES.

17 SC Code Ann 235 (1962).

Descriptors: *South Carolina, *Potable water, *Water quality, *Railroads, Ice, Coolants, Domestic water, Transportation, Public health, Human diseases, Water purification, Water storage, Water supply, Legislation, Interstate, Administrative agencies.
Identifiers: *US public health service, Certified water, Interstate quarantine.

Water provided for drinking or cooking in railway trains or stations must be certified by the United States public health service as meeting interstate quarantine regulations of the United States. Ice used to cool such water must be clear, natural ice made from distilled or certified water. If such ice contacts the water, it must first be washed and handled so as not to contaminate the water with infectious organisms. Ice not contacting the water need not meet these standards, and all newly constructed railroad cars shall be made so that cooling ice does not contact the water. When water and ice are put in the same compartment, the tank shall be cleaned each week it is in use, and drained and flushed at least once a month. Portable tubing used to fill drinking water containers shall have smooth metal nozzles protected from dirt and contamination. Such tubing shall be flushed prior to each filling. (Harris-Fla)
W69-08187

MOHESKY V CITY OF WASHINGTON (FLOOD DAMAGE CAUSED BY STREET IMPROVEMENT).

432 SW2d 364-367 (Ct App Mo 1968).

Descriptors: *Missouri, *Floods, *Flow augmentation, *Highway effects, Highways, Construction, Drainage, Damages, Local governments, Adjudica-

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tion procedure, Remedies, Judicial decisions, Obstruction to flow, Alteration of flow.

Plaintiffs brought an action for damages against the city and its engineer because their raising of the grade of a street in front of plaintiffs' property caused increased flowage on plaintiffs' land, flooded plaintiffs' basement, and hindered part of their land inaccessible from the street. A new trial was granted the city on grounds of excessiveness of the $3,500 verdict awarded plaintiffs. On appeal by plaintiffs, the trial court's action in granting the new trial was upheld. The appellate court could not weigh the evidence, but only determine whether there was evidence that reasonable supported the trial court's decision. (Kahle-Fla)
W69-08188

STATE V CORE BANKS CLUB PROPERTIES INC (CONDEMNATION OF LAND FOR USE AS NATIONAL PARK).
167 SE2d 385-392 (NC 1969).

Descriptors: *North Carolina, *Condemnation, *National parks, *Seashores, Land use, State governments, Administrative agencies, Federal government, Legislation, Judicial decisions, Adjudication procedure, Public benefits.

Plaintiff, state of North Carolina, acting through its Department of Administration, sought to condemn defendant's shoreline property in order to convey it to the United States for a national park. The court held that such condemnation would be for a proper public purpose, since some benefit would accrue to the state. A statute granting the Department of Administration the power of eminent domain, however, did not authorize that agency to decide public purpose or initiate state projects utilizing the power of eminent domain. The statute merely appointed the department as an acquisition agent for the state. Since no express legislation authorized the department to condemn seashore property in order to convey the same to the United States, the department was without power to condemn defendant's land. (Kahle-Fla)
W69-08189

CITY OF LOUISVILLE V LOUISVILLE SEED COMPANY (MUNICIPAL TORT LIABILITY FOR FLOOD DAMAGE).
433 SW2d 638-644 (Ky 1968).

Descriptors: *Kentucky, *Floods, *Flood damage, *Local governments, Remedies, Damages, Adjudication procedure, Judicial decisions, Floodgates, Flood control, Public benefits, Cities.
Identifiers: *Municipal tort liability.

Plaintiff was awarded damages for an injury allegedly caused by flood waters resulting from defendant city's failure to install flood gates in the municipal flood wall system. On appeal, the judgment was reversed. The court held that a city could not be held liable in tort for a risk which was inherently part of the function of government. The city was not legally required to engage in the maintenance of flood control facilities. A city can be held liable only where it deals with a party on an individual basis, rather than as a member of the general public. Flood control facilities were beneficial to the entire citizenry and plaintiff's damage could not be separated from damages occasioned by the general public. (Kahle-Fla)
W69-08190

BALDWIN V ANDERSON (TITLE TO LAND FORMED BY AVULSION OR ACCRETION).

40 Wis 2d 33, 161 NW2d 553-560 (1968).

Descriptors: *Wisconsin, *Accretion (Legal aspects), *Avulsion, Land forming, Land tenure, Land classification, Rivers, Boundaries (Property), Judicial decisions, Legal aspects, Water law, Watercourses (Legal), Boundary disputes, Riparian land, Riparian rights.
Identifiers: Doctrine of 'doubtful title'.

The sellers of a farm, one original boundary of which was a river, brought an action to collect on a note given by the buyers as earnest money for the proposed sale. The lower court dismissed the complaint and the sellers appealed. When the sale had been completed it was not known whether the river originally forming the southern boundary of the property had shifted its course through accretion or avulsion. Therefore, it was not known whether title to the newly formed land was in the owners of the farm or in a riparian owner of lands originally north of the river. The buyers, believing that there was reasonable doubt of merchantable title refused to close the transaction. The court, after defining avulsion and accretion and discussing their effects on land ownership, held that there was reasonable doubt whether title to the farm was merchantable and the purchasers were justified in refusing to close the transaction. (Carruthers-Fla)
W69-08191

SMITH V BOARD OF COUNTY ROAD COMMISSIONERS OF CHIPPEWA COUNTY (FLOOD DAMAGE CAUSED BY ROAD CONSTRUCTION AND ACT OF GOD).

381 Mich 363, 161 NW2d 561-569 (1968).

Descriptors: *Michigan, *Highway effects, *Floods, *Rain water, Basins, Rainfall, Alteration of flow, Obstruction to flow, Damages, Remedies, Ravines, Judicial decisions, Adjudication procedure, Roads, Local governments, Flood damage.
Identifiers: *Act of God.

Plaintiff, landowner, brought an action in trespass for flood damages allegedly caused by defendants, county road commissioners, changing of the road level near a basin. Plaintiff charged that the altered road level was a contributing and concurring cause of water breaking through and washing out a road on the opposite side of the basin and washing plaintiff's residence and inhabitants into a large ravine created by the water. The sole issue was whether plaintiff's damages were caused solely by an act of God, torrential rainfall, or whether defendants' act was a contributing cause which would render them liable. Upon judgment for defendant and appeal by plaintiff the appellate court upheld the trial court's decision that the issue was one solely for jury determination. The Supreme Court affirmed the appellate court's decision. The dissent felt that there could be no finding that defendants were not contributorily causative and would have reversed solely on the issue of damages. (Kahle-Fla)
W69-08192

POWERS OF THE GOVERNOR AND COUNCIL.

NH Rev Stat Ann secs 4:10 (1955), 4:40-A, 4:40-B, 4:40-C, 4:40-D (Supp 1967).

Descriptors: *New Hampshire, *Beds under water, *Ownership of beds, *Interstate rivers, Political aspects, Legislation, Administrative agencies, Administrative decisions, Water law, Water policy, Legal aspects, Ponds, Navigable waters, Streambeds, Sands, Gravels, Water management (Applied), Public rights, Diversion, Rivers, Financing, Water resources.
Identifiers: *Deeds.

The governor may institute suits in the name of the state when, in his judgment, they are necessary to prevent the injurious diversion of the water of rivers which naturally flow from other states into New Hampshire. After consultation with the fish and game commission and other state agencies as may be involved the governor and counsel upon just consideration may convey sand and gravel which is on the bed of any navigable water or great pond. A great pond is any public water of more than ten acres. Petition for such conveyance is considered by the water resources board and, upon approval by it, the governor has an appropriate deed prepared. The board's recommendation incl all appropriate specifications and conditions n sary to the protection of public and private ri Consideration paid for taking sand or grav credited by the state treasurer to the appropri for the water resources board. (Johnson-Fla)
W69-08193

POWERS AND DUTIES OF TOWNS.

NH Rev Stat Ann sec 31:4 (1955), as amer (Supp 1967).

Descriptors: *New Hampshire, *Local go ments, *Dams, *Flood control, Legislation, L aspects, Water law, Water policy, Interstate pacts, Federal government, Recreation, Recre facilities, Financing, Economics, Political asp Waste disposal, Cities, Projects.

Within New Hampshire, the power of town raise and appropriate money is derived solely statutory provisions which restrict this powe such areas as the following: dams, collection removal of waste materials, and federal o terstate flood control projects. Towns may acq construct, control and operate dams at the outl any body of water when such action will imp the recreational value of such body of w Towns must provide means for collection, rem and destruction of garbage and other waste ma als. Towns acting jointly or separately in ord protect their interests with respect to federal f control projects, etc may make necessary propriations for such purposes. (Johnson-Fla)
W69-08194

PROTECTION OF WATER SUPPLY.
NH Rev Stat Ann sec 38:21 (Supp 1967).

Descriptors: *New Hampshire, *Water sou *Eminent domain, *Local governments, L aspects, Water law, Water policy, Legislation, cial decisions, Priorities, Preferences (W rights), Water, Water costs, Water quality, Ad cation procedure, Prescriptive rights, Jurisdic Relative rights, Cities, Domestic water.

Any municipality or water company suppl water to the public for domestic use has the po to exercise the right of eminent domain over property needed to protect the purity of such w supply. Such power is exercised by petition to superior court or, in the case of a village distric the board of selectmen of the town or towns w which the district is situated. Proceedings the are identical to those where there is a petition laying out a highway. (Johnson-Fla)
W69-08195

IMPROVEMENT OF SWAMP LANDS.
NH Rev Stat Ann secs 431:1 thru 431:5 (1968)

Descriptors: *New Hampshire, *Swamps, *L reclamation, Landfills, Adoption of pract Economics, Financing, Legislation, Administra agencies, Legal aspects, Natural resources, management, Land development, Conserva Drainage, Drainage practices, Wetlands, L forming, Public health, Land use, Land man ment, Marshes.
Identifiers: Swamp lands.

Selectmen, upon petition, may cause any lo swamp lands within their town to be draine filled when the public health or good, or the vancement of agriculture, requires it. They ma out or take such land, easements, or rights and as may be necessary for the purpose. Damages be awarded to any owner of land so taken, these must be set off against any benefit accrui him from the improvement. Persons benefited to be assessed to the extent of the benefit to th Such assessments have the same effect, ma abated or corrected and shall be collected in same way, as in the case of assessments for s walks and sewers. (Johnson-Fla)

-08196

BORS AND PUBLIC WATERS.

Rev Stat Ann secs 271:8 thru 271:21 (1966).

riptors: *New Hampshire, *Harbors, *Water tion, *Navigable waters, Public rights, Pollu-, Pollution abatement, Streams, Ponds, Land re, Riparian rights, Ice, Navigation, Legisla- Fresh water, Legal aspects, Marking niques, Water pollution control, Water pollu-ources.
ifiers: Dumping, Ice harvesting, Public ways, Public waters.

y person shall unload, cast or throw out of any vessel or boat, or from shore or wharf, any st or other filth into the harbor, he shall forfeit nore than ten dollars. Navigable streams or rs are those which are used, or are susceptible eing used in their ordinary condition, as ways of commerce, over which trade or travel may be conducted in the present customary es of trade or travel on water, and such term not apply to streams or waters which are used ly as public highways for floating logs. Anyone esting ice on any public waters shall put up ble markers indicating the area of harvest. ne who violates this provision shall be fined hundred dollars, or imprisoned not more than ays, or both. All natural bodies of fresh water h have an area of twenty acres or more are ic waters. The state holds all public waters in for the public use. No person or corporation have or exercise in any public waters any s or privileges not common to all citizens of tate. (Gadd-Fla)
-08197

SWELL V STATE HIGHWAY AND PUBLIC RKS COMM'N (WATER DAMAGE FROM ERSION).
primary bibliographic entry see Field 04C.
-08311

KENSACK WATER COMPANY V VIL-E OF NYACK (ACTION TO RECOVER WITHDRAWAL LOSS).
primary bibliographic entry see Field 04C.
-08312

ERAGE AUTHORITIES LAW.
primary bibliographic entry see Field 05G.
-08313

ING OUT, ALTERING AND DISCONTINU-HIGHWAYS.
primary bibliographic entry see Field 04C.
-08314

ISDICTION OVER OFFSHORE WATERS SUBMERGED LANDS.

Rev Stat Ann tit 1, secs 2, 3, 13, 14, 15 (1965); Rev Stat Ann tit 1, sec 27 (Supp 1968-69).

criptors: *Jurisdiction, *Beds, *Oceans, ine, Legislation, Legal aspects, Ownership of , United States, Condemnation, Surveys, ds, Great ponds, Tidal waters, Water rights, e governments, Eminent domain, Federal rnment, Jurisdiction.
tifiers: Offshore waters, Navigation aids, Mar-l sea, High sea.

ne's jurisdiction over offshore waters shall ex- as follows: over the outermost limits of the ginal sea as recognized by the United States; the high seas to the extent jurisdiction is ned by the United States; and over all sub-ged lands lying under these waters. The owner-of the waters and submerged lands described ve shall be in the state. The Governor, when required by public exigencies, may acquire lands or rights of way for fortifications or the erection of navigation aids. Jurisdiction or possession of such lands may be given to the United States. A survey of the land to be taken must be made. The filing of the plan with the Secretary of State shall vest title to the land in the state. The title to all islands in great ponds and title to all islands located in the sea within the jurisdiction of the state shall remain in the state and not be sold. (Childs-Fla)
W69-08315

STATE OF NEW HAMPSHIRE V ATOMIC ENERGY COMM'N (EVIDENCE OF POSSIBLE THERMAL POLLUTION NOT WITHIN JURISDICTION OF AEC).
For primary bibliographic entry see Field 05G.
W69-08316

DIVISION OF PARKS AND RECREATION.

Minn Stat Ann secs 85.20, 8532 (1964).

Descriptors: *Minnesota, *Parks, *Boating, *Recreational facilities, Camp sites, Fishing, Forest management, Hunting, Lakes, Land use, National parks, Recreation, Scenery, Landscaping, Lumber, Wildlife, Fish, Streams, Water levels, Damages, Boating regulation, Rivers, Navigation, Dams, Waterfalls, Eddies, Easements, Legislation.
Identifiers: Trespass, Misdemeanor, Penalties, Portages, Rapids, Hazards to navigation.

Any person who cuts, injures, or takes any tree, timber, or plant in Itasca State Park, or kills or hunts any wild animal, or who, without the consent of the director, takes any fish from the waters, raises or lowers any lake or stream in the park, or sets any fire in the park, or damages any building or property of the state therein, shall be guilty of a misdemeanor and the minimum punishment shall be a $50 fine. The commissioner of conservation is authorized to mark canoe and boating routes along the rivers of the state which have historic and scenic values. He may mark points of interest and camp sites and all dams, rapids, waterfalls, whirlpools, and other hazards which are dangerous to canoeing. The commissioner may take land by easements and by leases to make camp sites along the routes of the river. (Shevin-Fla)
W69-08317

MICHALKA V GREAT NORTHERN PAPER COMPANY (FLOOD DAMAGE).
For primary bibliographic entry see Field 04A.
W69-08318

LUENING V PUBLIC SERVICE COMMISSION (PERMIT TO CONSTRUCT HYDROELECTRIC DAM).
For primary bibliographic entry see Field 8C.
W69-08319

CONSTRUCTION AND REPAIR OF BRIDGES AND DRAINAGE SYSTEMS.
For primary bibliographic entry see Field 04A.
W69-08320

CAMPBELL V STATE HIGHWAY COMMISSIONER (COMPENSATION FOR CONDEMNATION OF A SPRING AND AN EASEMENT).
For primary bibliographic entry see Field 04C.
W69-08321

GUESS V AZAR (RIGHT OF WAY ACROSS PRIVATE PROPERTY).

57 So 2d 443-445 (Fla 1952).

Descriptors: *Florida, *Easements, *Right-of-way, *Access routes, Beaches, Shores, Gulf of Mexico, Bays, Intertidal areas, Tides, High water mark, Low water mark, Transportation, Roads, Barriers, Legal aspects, Judicial decisions, Navigable waters, Farms, Livestock, Public benefits, Land tenure, Remedies.
Identifiers: Ingress, Egress, Shells, Contempt of court, Injunction (Prohibitory).

The plaintiff's land was bounded on one side by the Gulf of Mexico and on the other side by Sarasota Bay. Defendant's land adjoined plaintiff's land and his only access was along the foreshore or over plaintiff's land. Plaintiffs sought an injunction to prevent the defendant from hauling shell across their land. The lower court granted the relief plaintiffs requested. The defendant violated the injunction and was adjudged in contempt. In his order the chancellor stated that the defendant had a statutory right of way over plaintiff's land for the purpose of home, argicultural and stock raising, but for no other purpose. All other purposes would be in violation of the injunction. On appeal the court said that the defendant had no right to violate the chancellor's order. The court held the chancellor to be correct in limiting the route for removal of shell to the foreshore, as the foreshore by its very nature was available to the public for access. The court held this condition must exist until a public road across plaintiff's property was opened. (Shevin-Fla)
W69-08322

GAINESVILLE STONE CO V PARKER (DAMAGE TO LAND BY FLOODING CAUSED BY IMPROPER DAM MAINTENANCE).
For primary bibliographic entry see Field 04A.
W69-08323

PARISH OF EAST BATON ROUGE V BARBAY (COMPENSATION FOR PROPERTY TAKEN FOR DRAINAGE CANAL CONSTRUCTION).
For primary bibliographic entry see Field 04A.
W69-08324

INTERSTATE WATER COMPACT.

Conn Gen Stat Ann, Secs 25-122 to 25-125 (Supp 1969).

Descriptors: *Connecticut, *Interstate compacts, *Administrative agencies, *Water supply, Legislation, Interstate rivers, Interstate commissions, Cities, State governments, Water delivery, Water distribution, Applied distribution systems, Investigations, Projects, Governors.
Identifiers: Connecticut Interstate Water Compact Commission.

The governor is authorized to enter into a compact with other states to collect, transport, and distribute water for use by the state's municipalities. Every agency, board, commission, or administrative group shall make their records, information, and research available to the governor without charge. The Connecticut Interstate Water Compact Commission is created to assist the governor in determining the advisability of entering such compact. (Stewart-Fla)
W69-08325

WILDLIFE MANAGEMENT.

W Va Code Ann, Sec 20-2-3, 20-2-5, 1966, as amended (Supp 1968).

Descriptors: *West Virginia, *Administrative agencies, *Wildlife conservations, *Fishing, Sport fishing, Aquatic life, Legislations, Regulation, Fish management, Fish migration, Fishkill, Toxins, Navigable waters, Ponds, Lake, Permits, Fish conservation, Explosives.
Identifiers: Felonies.

The ownership and title to all wild animals and birds, both migratory and resident, and all fish is in the state as trustee for the people; however, all fish

in private ponds are the private property of the pond owners. It is unlawful for any person to have any hunting or fishing gear which cannot be lawfully used in this state. Conservation officers are authorized to confiscate or destroy any such gear which they find. It is also unlawful to catch, take, kill or attempt to catch any fish at any time except by rod, line, and hooks unless otherwise authorized. It is unlawful to use any explosive or poison in state waters to kill or catch fish. Violation of this provision is a felony. Fish located in state waters are subject to regulations by the state while those in private ponds may be caught at any time. (Stewart-Fla)
W69-08326

POWERS AND DUTIES OF CONSERVATION OFFICERS.

W Va Code Ann sec 20-7-4 (1966).

Descriptors: *West Virginia, *Legislation, *Wildlife conservation, Natural resources, Forests, Parks, State governments, Legal aspects, Conservation, Administration, Administrative agencies, Local governments, Recreation, Fishing, Hunting, Fishing gear.

Conservation officers shall be supervised and directed by the director of the Department of Conservation in the performance of their duties. The authority and duties of the conservation officers shall be statewide and they shall have authority to: (1) arrest without a warrant any person detected by them in the violation of any of the provisions of this chapter except where otherwise provided, (2) carry arms and weapons, (3) search and examine, in the manner provided by law, any boat, vehicle, etc or any other place where hunting and fishing equipment or wildlife could be concealed when they have probable cause to do so, (4) execute and serve any process of law issued under authority of this chapter, or copies of orders made and entered by the chief of the division of water resources, (5) to stop any motor vehicle for the purpose of conducting game-kill surveys, (6) summon aid in making arrests or seizures, (7) enter private lands or waters while performing their official duties, (8) arrest on sight, subject to limitations, any person committing a criminal offense on national forest lands, (9) do all things necessary to carryout these provisions. (Carruthers-Fla)
W69-08327

RIVERS AND STREAMS AS LAWFUL FENCES.
W Va Code Ann sec 19-17-2 (1966) as amended, (Supp 1968).

Descriptors: *West Virginia, *Rivers, *Streams, *Riparian rights, Legislation, Boundaries (Property), River regulation, Barriers, Land tenure, Adjudication procedure, Legal aspects.
Identifiers: *Fences, Counties, Notice, Publication.

All rivers and streams that are lawful fences at the effective date of this statute shall continue to be so until otherwise ordered by the county court. The county court, upon application from the owner or tenant of lands on a river or stream constituting a boundary line of the county may declare and establish such river or stream to be a lawful fence. Notice of the application must be given by publication in the county, and interested parties may appear to oppose the application. The court may also annul or amend any previous order establishing a river or stream as a lawful fence; however, such revocation cannot be made within one year after the date of the order to be annuled, and shall not take effect until six months after it is made. (Shevin-Fla)
W69-08328

THE MARITIME BOUNDARIES OF THE STATES.
Avrum M. Gross.
Mich L Rev, vol 64, No 3, pp 639-670, Jan 1966. 32 p, 132 Ref.

Descriptors: *Law of the sea, *Submerged Lands Act, *International waters, Boundaries (Property), Ownership of beds, State governments, Federal government, Low water mark, International law, Inland waterways, Legislation, Shores, Coasts, Political aspects, Commercial fishing, Seashores, Bays, Inlets (Waterways), Boundaries (Surfaces), Locating, Water law, Legal aspects, Conferences, Watercourses (Legal), Federal-state water rights conflicts.
Identifiers: *Marginal seas, *Historical waters, Maritime areas.

While it has long been recognized that the seaward boundaries of coastal states encompass certain adjoining maritime areas, confusion over their precise location has engendered dispute. The First Law of the Sea Conference, convened at Geneva in 1958, helped to reduce these differences by establishing international norms for boundary delineation. A need for such norms also existed on the federal level in the United States. In an attempt to reduce disputes between the federal and state governments, Congress passed the Submerged Lands Act which granted the states title to all lands under navigable waters within a set distance from their coast as measured from the low water mark or the seaward limit of the inland waters. But in the absence of the establishment of standards regarding the location and extent of 'inland waters', uncertainty still remained. Finally, the Supreme Court was called upon to interpret this act. They adopted the standards agreed upon at the Geneva Convention as a workable definition of 'inland waters.' While boundary delineation problems will continue to arise within the Federal area, the adoption by the court of objective standards supported by international consensus has helped create a framework for orderly division of maritime jurisdiction between state and federal authorities. (Gabrielson-Fla)
W69-08329

POWER TO CROSS ROADS, HIGHWAYS AND STREAMS; CROSSING CANALS OR NAVIGABLE WATERS.

Md Ann Code Art 23, secs 203, 206 (1966), as amended, (Supp 1968).

Descriptors: *Maryland, *Railroads, *Streams, Bridges, Canals, Administrative agencies, Administrative decisions, Navigable waters, Nonnavigable waters, Roads, Highways, Transportation, Road construction, Streambeds, Diversion, Diversion structures, Legislation, Regulation, Legal aspects, Eminent domain, Railroad relocation, Engineering structures, Piers, Bridge design.
Identifiers: Crossings, Free passage.

Any railroad, in the construction of its road, may cross any road, highway or stream and divert the stream provided it be non-navigable. It is lawful for any railroad corporation whose railroad crosses a road or highway to carry the same over its tracks by an overgrade crossing or under its tracks by an undergrade crossing. The road or highway can be diverted from its existing location and the railroad can use appropriate legal processes if necessary to appropriate buildings, gardens or yards concomitant to such diversion. The railroad shall promptly replace such road, highway or stream so as not to impair its former usefulness. Such railroad will be liable for any damages caused by stream diversion. Whenever the line of any railroad company crosses any navigable water, said company shall file with the Board of Public Works the plan of fixtures to be utilized in the crossing. The Board's approval shall be in writing. If the kboard disapproves the plan, recourse can be had by the railroad in the circuit court which can appoint a disinterested engineer to prescribe a plan and can then issue an order of confirmation. But no railroad company can construct any permanent bridge less than 12 feet above the top water line, nor shall any piers or abuttments be placed so as to interfere with free passage. (Carruthers-Fla)
W69-08330

FUND FOR WATERWAY IMPROVEM PROJECTS IN CHARLES COUNTY; BUILD ACROSS NAVIGABLE RIVER PROHIBITE

Md Ann Code Art 25, secs 3 (bb), 49 (1957 amended (Supp 1968).

Descriptors: *Maryland, *Water management plied), *Navigable rivers, *Channel improve Bridges, Administrative agencies, Legisla Legal aspects, Public benefits, Expendit Separable cost allocation, Mosquitoes, B waters, Navigable waters.
Identifiers: Drawbridge.

The County Commissioners of Charles Count authorized to maintain a $40,000 fund to pro for channel improvement, breakwater cons tion, mosquito control and other waterway provement projects in county waters; how nothing in this article authorizes any county missioners to build any bridge or drawbridge a any navigable river. (Carruthers-Fla)
W69-08331

PUBLIC LANDINGS.

Md Ann Code Art 25, secs 156, 157 (1957 amended, (Supp 1968).

Descriptors: *Maryland, *Public bene *Recreation facilities, Navigable waters, Rec tion, Navigable rivers, Canals, Bays, Administra agencies, Permits, Roads, Local governments.
Identifiers: *Public landing, Sounds, Public venience, Application

Where public convenience so requires, the co commissioners are empowered to establish a pu landing on any navigable waters in the county plications for the establishment of such a pu landing shall be handled by the same proceed as that for applications to open a public road; the procedures in this section shall not be appl ble in Queen Anne's County. (Carruthers-Fla)
W69-08332

SHORE EROSION CONTROL DISTRICTS.
For primary bibliographic entry see Field 04D
W69-08333

CONSERVATION OF WATER.
For primary bibliographic entry see Field 04A
W69-08334

NATURAL RESOURCES.

Md Ann Code Art 66C secs 25, 27, 30 (1957).

Descriptors: *Maryland, *Administrative agenc *Mining, *Regulation, Water policy, Legal aspe Legislation, State governments, Permits, Fina ing, Taxes, Tax rate, Ownership of beds, Beds, B under water, Riparian rights, Navigation, Nav ble waters, Natural resources, Soils, Royalties
Identifiers: Rare earths, Minerals.

Persons or business entities desiring to extract earth and minerals from the public lands under Chesapeake Bay must apply to the Board of N ral Resources of the State. Applications must clude a description of the land and, where pract ble, stakes should be driven in order that a sur may be made. Both the Board of Natural Resou and the Board of Public Works must approve s application. The discoverer of the location of earths and minerals is given preference as aga other applicants. Permits and leases will con such regulations as are deemed necessary for protection of navigation channels and other terests of the state. Permits may not be granted certain areas. Although the royalty per ton minerals or rare earth may be changed by legislature from time to time, the rights of ripa owners shall not in any way be invalidated. (Jo son-Fla)

8335

CONSERVATION DISTRICTS.
mary bibliographic entry see Field 04D.
8336

KS OR RUNS; WIDENING, GHTENING, ETC.
mary bibliographic entry see Field 04A.
8337

HIGHWAY DEPARTMENT, COST NG IN HIGHWAY PROJECTS.
mary bibliographic entry see Field 04C.
8338

TRUCTION OF IMPROVEMENT.
mary bibliographic entry see Field 04A.
8339

EDURE TO ESTABLISH DISTRICTS.
mary bibliographic entry see Field 04A.
8340

TING TIMBER AND DAMAGE EFROM.
mary bibliographic entry see Field 04C.
8341

VATING AND DREDGING IN PUBLIC ERS.
mary bibliographic entry see Field 04A.
8342

L WATERS.
imary bibliographic entry see Field 04A.
8343

TATION OF HYDRO-ELECTRIC CHAR-

ev Stat Ann secs 483:1, 483:2 (1968).

iptors: *New Hampshire, *Hydroelectric , *Hydroelectric project licensing, *Dams, construction, Legislation, Remedies, Mill Powerplants, Construction, Streams, Over- Reservoirs, Water law, Legal aspects, Water tion, Permits, Limiting factors, Judicial deci- Flow, Flow control.
fiers: Penalties (Civil), Forfeiture.

ghts, powers, privileges and franchises con- upon any corporation enabling it to con- and maintain mill dams or overflow lands for electric purposes shall be forfeited unless ac- onstruction work thereon has commenced six years of the conferring of such rights and ame prosecuted with reasonable diligence fter until such structures are completed. If f the above stipulations are not met and fol- any private citizen may file a written com- with the attorney general setting forth a h of the above. It shall be the duty of the at- general to enforce by an appropriate eding, a forfeiture of the rights, powers, ges and franchises under which the corpora- ight have erected its dam or plant. (Holt-Fla) 08344

S AND FLOWAGE (ADMINISTRATION, CEDURE, AND APPEALS OF NEW PSHIRE WATER RESOURCES BOARD).
rimary bibliographic entry see Field 04A.
08345

ING FILL IN PUBLIC WATERS.
rimary bibliographic entry see Field 04A.
08346

EQUIPMENT AND OPERATION OF VESSELS.

SC Code Ann secs 70-295 thru 70-295.17 (1962), as amended, (Supp 1968).

Descriptors: *South Carolina, *Boats, *Safety, *Boating regulations, Regulation, Water skiing, Standards, Legislation, Recreation, Safety factors, State jurisdiction, Navigable waters, Permits, Accidents, Marinas.
Identifiers: Flotation standards, Negligent operation, Alcohol, Drugs, Penalties (Fines), Penalties (Imprisonment).

The provisions herein apply to any vessel operated on waters of this state. The administration of this chapter is vested in the Wildlife Resources Department which shall set up a Division of Boating and carry out a program of safety education and training for law enforcement officers. No vessel not already in the hands of a dealer, other than one constructed of wood, shall be sold after January 1, 1962, unless its serial number is imprinted on the transom and unless it meets flotation standards of the Division. Owners of boat liveries must keep records for 6 months of the names and address of persons hiring vessels, identification number of the boat, departure time and expected time of return. Boats or water skis shall not be operated negligently or while the operator is under the influence of alcohol or drugs. The owner of a vessel is liable for its negligent operation unless such vessel is used without his express or implied consent. An operator of a vessel involved in an accident must render aid, leave his name and address, and where damage exceeds $100 or death occurs, file a report with the Division. Fines and imprisonment are imposed for violation of these provisions which may be enforced by any peace officer of the state. (Kahle-Fla)
W69-08347

PROTECTING WATER AND ICE SOURCES.
For primary bibliographic entry see Field 05G.
W69-08348

PROTECTING WATER AND ICE SOURCES.
For primary bibliographic entry see Field 05G.
W69-08349

PROTECTING WATER AND ICE SOURCES.
For primary bibliographic entry see Field 05G.
W69-08350

PROTECTING WATER AND ICE SOURCES.
For primary bibliographic entry see Field 05G.
W69-08351

ACQUISITION OF LAND BY UNITED STATES FOR FLOOD CONTROL AND NAVIGATION.
For primary bibliographic entry see Field 04A.
W69-08352

CLASSIFICATION OF WATERS AND STANDARDS OF PURITY.
For primary bibliographic entry see Field 05F.
W69-08353

FLOWAGE.
For primary bibliographic entry see Field 04A.
W69-08354

GOLDIN V TRUSTEES OF VILLAGE OF ELLENVILLE (INTERFERENCE WITH WATER SUPPLY BY CITY).
For primary bibliographic entry see Field 04C.
W69-08355

DELAWARE RIVER AND BAY AUTHORITY.

Del Code Ann tit 17, sec 1801-1808 (Supp 1966).

Descriptors: *Delaware, *New Jersey, *Bridges, *Interstate compacts, Federal government, State governments, Interstate commissions, Bridge construction, Construction costs, Legislation, Financial analysis, Maintenance, Management, Administrative agencies.
Identifiers: *Delaware Memorial Bridge, Tolls, Toll bridges, Interstate bridges, Bond financing, Bridge management, Delaware-New Jersey Compact.

The Delaware River and Bay Authority shall be the agent for Delaware and New Jersey in connection with the construction, maintenance and control of the Delaware Memorial Bridge. The authority shall succeed to all rights and duties formerly vested in the Delaware Interstate Highway Division in so far as they pertain to the bridge. The authority's control shall be subject to the rights of holders of outstanding Delaware Memorial Bridge Revenue Bonds of the state of Delaware. The authority shall arrange with the Interstate Highway Division for an audit and for fixing a date upon which the books of the Division shall be closed and from which the authority shall take over control of the bridge. This chapter shall take effect upon completion of the last of the following three events: (1) when the Delaware-New Jersey Compact becomes binding on this state; (2) when New Jersey enacts legislation having a substantial identical effect with this chapter; and (3) when the US Congress enacts an amendment to 60 stat 533 eliminating the requirement that the bridge become toll free upon payment of the outstanding bonds.
W69-08356

DAMS AND FLOWAGE: PROCEEDINGS IN COURT.
For primary bibliographic entry see Field 04A.
W69-08357

POLLUTION CONTROL AUTHORITY OF SOUTH CAROLINA.
For primary bibliographic entry see Field 05G.
W69-08358

SOUTH CAROLINA WATER RESOURCES PLANNING AND COORDINATING COMMITTEE.

SC Code Ann secs 70-21 thru 70-25 (Supp 1968).

Descriptors: *South Carolina, *Water resources development, *Water quality control, *Water management (Applied), Water utilization, Industrial water, Municipal water, Administrative agencies, Research and development, Legislation, State governments, Hydroelectric power, Navigation, Flood control, Drainage, Watershed management, Wildlife management, Water supply.

The South Carolina Water Resources Committee with 18 members appointed by the Governor is created. The interests represented are agriculture, industry, municipalities and salt water interests. Eight other members shall be the heads of the Department of Agriculture, Pollution Control Authority, Wildlife Resources Commission, State Forestry Commission, Soil and Water Conservation Committee, State Development Board, Clemson University Water Resources Research Institute, and the State Highway Department. The committee is authorized to conduct studies for the purpose of making recommendations to the Governor and to the General Assembly regarding a comprehensive water resources policy for the state. The committee may review actions of state agencies and federal projects in regard to water resources with a view toward establishing a consistent water resources policy. The committee, in exercising its duties, shall consider the need for: adequate supplies of water for domestic, industrial, agricultural and municipal uses; water quality controls; navigation facilities; hydroelectric power; flood control; land stabilization; drainage; watershed management; and wildlife management. (Kahle-Fla)
W69-08359

REGULATION OF WATER RESOURCES.
For primary bibliographic entry see Field 04A.
W69-08360

DAMS IN DISREPAIR AND CHANNEL IMPROVEMENT.
For primary bibliographic entry see Field 04A.
W69-08361

FENCING WATER-WAYS.
NH Rev Stat Ann sec 475:1-475:3 (1968).

Descriptors: *New Hampshire, *Canals, *Safety, *Cities, Ditches, Streams, Legislation, Regulation, Local governments, Municipal water, Safety factors.
Identifiers: *Fences.

The elected officials of any town or city may require the owner or user of any canal or waterway within the city or town, deemed by them to be dangerous to travelers or children, to fence the same. Upon failure of the owner to fence the canal within 60 days after written notice, the officials shall have the canal fenced, and collect the expenses from the owner or user in an action of assumpsit. (Kahle-Fla)
W69-08362

LEGAL FENCES; WATERS, WHEN NOT SUFFICIENT FENCE.

NH Rev Stat Ann sec 473:5, 473:7 (1968).

Descriptors: *New Hampshire, *Boundaries (Property), *Boundary disputes, *Rivers, Ditches, Streams, Legislation, Regulation, Adjudication procedure, Construction, Legal aspects.
Identifiers: *Fences, *Fence viewers.

All fences in good repair and of such height as to be reasonably adequate for their purpose and all rivers, ponds, creeks, ditches and hedges deemed by the fence viewers as equivalent thereto, shall be termed legal and sufficient fences. The fence viewers, upon application of either party, shall view any river, pond, creek, or ditch alleged not to be a sufficient fence. If they determine that it is not sufficient, they shall make a division of the fence. If it is unreasonable to build a fence on the boundary line they shall determine where it shall be built and give notice to the parties to build it according to the division and location. (Kahle-Fla)
W69-08363

FISH CONSERVATION RULES AND REGULATIONS.

Vt Stat Ann tit 10, secs 4601-4611 (Supp 1968).

Descriptors: *Vermont, *Conservation, *Fish conservation, Fish management, Fish stocking, Wildlife, Sturgeon, Pikes, Trout, Sport fish, Fisheries, Water conservation, Streams, Fish farming, Fish hatcheries, Legislation, Fish, Regulation, Administrative agencies, Water policy, Water sports, Recreation, Sport fishing, Legal aspects, Ice fishing.
Identifiers: Pickerel.

No person shall take or possess fish in violation of regulations relating thereto. Fish taken unintentionally but illegally shall immediately be released. Ice fishing, is allowed only by board regulation. Pickerel or great northern pike shall not be introduced into any waters or any other fish introduced into any waters without first obtaining permission to do so. No fish shall be taken by (1) explosives; (2) drug or poison; (3) shutting or drawing off water; (4) illegal nets, set lines, fishing otter, trawl, jack light, electrical or other such device. Unless authorized, no person shall obstruct a natural or artificial stream. Except as authorized and regulated by the Commissioner of Conservation, no one shall fish for sturgeon. Importation of dead trout for sale shall be subject to regulation by the Commissioner. No person shall buy or sell a salmon, trout or black bass taken in this state or imported from a place where such sale is prohibited except when such fish is reared in licensed propagation farms. (Helwig-Fla)
W69-08364

ROAD CONSTRUCTION.
For primary bibliographic entry see Field 04C.
W69-08365

POLLUTION, POISONING, ETC., OF STREAMS; DYNAMITING.
For primary bibliographic entry see Field 05G.
W69-08366

KOSTON V TOWN OF NEWBURGH (WATER DISTRICT ASSESSMENT).

299 NYS2d 1007-1009, 1969.

Descriptors: *New York, *Water districts, *Assessments, *Municipal water, Cities, Wells, Judicial decisions, Legal aspects, Water law, Land tenure, Public rights, Public benefits, Taxes.

Petitioner, a landowner having his own private well, was located in a certain water district. He was assessed for the water district benefits, as were all persons owning real property in the water district. Petitioner paid the assessment under protest contending that he derived no benefit from the water district since he had his own water supply. The court held that even though a property owner has made private arrangements to provide the service offered by a special improvement district, he may be assessed on a benefit basis for the service offered in the district. The test of whether land has been benefited is not whether any advantage on its owner has been received but whether its general value has been enhanced. Here since fire protection facilities were improved and property values enhanced, benefits had accrued and the assessment was proper. (Carruthers-Fla)
W69-08367

ANNUTTO V VILLAGE OF HERKIMER (MUNICIPAL LIABILITY FOR BLASTING CAUSING FLOOD DAMAGE).
297 NYS2d 295-296 (NY App Div 1968).

Descriptors: *New York, *Ice, *Obstruction to flow, *Ice breakup, Judicial decisions, Water law, Ice jams, Cities, Damages, Watercourses (Legal), Explosives, Flow, Flow around objects, Flow rates, Legal aspects, Local governments, Public benefits, Bridges, Flooding, Floodwater, Flood damage.
Identifiers: *Blasting, *Negligence, Strict liability.

A lower court found the Village of Herkimer, liable for flood damage caused to plaintiff as a result of the blasting of an ice jam which obstructed a local waterway. Strict liability was the basis for recovery. On appeal plaintiff's judgment was reversed. The court held that the blasting was done to secure the public safety and that before plaintiff could recover for damages caused by floodwater stemming from defendant's action, a case in negligence would have to be established. (Holt-Fla)
W69-08368

PUBLIC SERVICE COMPANIES.

SC Code Ann secs 58-651, 58-691 thru 58-702 (1962).

Descriptors: *South Carolina, *Railroads, *Canals, *Public utilities, Ships, Transportation, Canal construction, Public benefits, Navigation, Navigable waters, Legislation, Regulation, State jurisdiction, State governments, Leases, Condemnation, Dams, Reservoirs, Docks, Locks.
Identifiers: Canal corporations, Steamship lines, Public service companies.

Three or more persons desiring to form a ra
corporation, canal corporation, or steamboa
poration may do so by petition to the Secret
State setting forth: their names and addresse
name of the corporation; its principal place o
ness; the general nature of its business; the te
and routes of the railroad, canal or steambo
as well as towns and cities it will pass through;
minimum amount of capital stock to be i
Canal companies shall have all the powers o
tric light and power companies and may
maintain and lease canals, locks, dams, rese
and wharves. Necessary land may be acquir
purchase or condemnation when the canal
kept open for public navigation. Canal com
may mortgage their property and issue bond
state may acquire property of a canal co
upon payment of just compensation. No rig
the state in canals shall be transferred except
of the General Assembly. Nothing herein
prevent landowners from recovering just co
sation for injury to property rights. Steamship
panies may exact tolls for use of their whar
landings. Steamship lines between Savannah,
gia, and Bluffton, South Carolina, may not c
their schedule except upon ten days notice. (
Fla)
W69-08369

SOIL CONSERVATION AND IMPROVEME
For primary bibliographic entry see Field 04D
W69-08370

MINES AND MINERALS.

SC Code Ann secs 1-361, 1-363, 1-364, 1-3
367, 1-372, 1-376, 1-377, 1-379 thru 1-381 (
as amended (Supp 1968).

Descriptors: *South Carolina, *Phosphates,
ing, *State jurisdiction, Navigable waters, Str
Marshes, Land use, Permits, Leases, Rates, R
ties, Legislation, Administrative agencies, R
tion, Contracts, Ships, Boats, Dredging.
Identifiers: Penalties.

The Public Service Authority may lease m
rights, excluding phosphate, upon land own
the authority. The State Budget and Control
may lease state lands and waters under its co
Such leases shall be subject to laws enacted f
conservation of mineral resources. The
Budget and Control Board shall have the res
bility of protecting state interests in phos
rocks and phosphatic deposits in navigable st
and marshes. The Board may take such
necessary to protect such interests in ter
claimed by other parties. The Board may
leases to mine phosphate in state waters fo
terms as may be determined by the Board
Board may make a firm contract for royalty
paid to the state. The Board is vested with c
over all phosphate mining in state territory an
fix and alter the royalty to be paid to the st
fine of $10 per ton is imposed for mining phos
without a state license. It is unlawful to pu
phosphate from one not duly authorized to
such phosphate. Any unauthorized vesse
dredges used to mine phosphate are declare
feited to the state. Mining without a license
terfering with the Board, or anyone authori
the Board, is punishable by fine between $1
$500 and/or imprisonment not less than one
(Kahle-Fla)
W69-08371

INTERFERENCE WITH NAVIGATION, E
For primary bibliographic entry see Field 04A
W69-08372

**MISCELLANEOUS PROVISIONS (UNLA
DISCHARGE OF OIL IN CHARLESTON
BOR).**
For primary bibliographic entry see Field 05C
W69-08373

ISON FURNITURE CO. V SOUTHERN RPRISES, INC. (AVULSION).

W 2d 278-282 (Ark 1969).

ptors: *Arkansas, *Riparian rights, *Accre- Legal aspects), *Riparian land, Land tenure, use, Land forming, Land reclamation, s, Watercourses (Legal), Judicial decisions, aspects, Water law, Avulsion, Rivers, Boun- isputes.
iers: Adverse possession.

ffs brought suit to quiet title to 91 acres of n land on the Arkansas River. Defendant d title by adverse possession and by a chain veyances beginning in 1920. The chancellor that defendant had acquired the entire 91 by adverse possession for more than 7 years color of title. Plaintiffs claim title to the pro- as a natural accretion to their lands resulting gradual shifting back and forth of the chan- the river. The appellate court defined the o be whether the property came into being as nd or as an accretion to the mainland and the land to be an accretion. The court, in ng the chancellor, held that plaintiffs have nstructive possession of all their land not ac- occupied adversely by defendant or his cessors in title. Hence, defendant's claim be confined to that part of the riparian tract to have been adversely occupied for 7 or successive years. (Carruthers-Fla)
08374

E EX REL TETER V STATE ROAD COM- ION (DAMAGE ASCERTAINMENT).
rimary bibliographic entry see Field 04C.
08375

TH AMERICAN WATER SUPPLY BLEMS AND THEIR SOLUTION,
ican Bar Association, Chicago, Ill.
rimary bibliographic entry see Field 06B.
08380

OPOSED PARTNERSHIP COMPACT FOR NATION'S RIVER,
rimary bibliographic entry see Field 06B.
08487

UEHANNA FLATS.

Ann Code Art 66C secs 165, 171, 173A).

iptors: *Maryland, *Hunting, *Waterfowl, rian rights, Legislation, Regulation, Water ation, Legal aspects, Water law, Recreation, ife, Fishing, Management, Water rights, rences (Water rights), Competing uses, ian land, Riparian waters, Wildlife conserva-

ifiers: Chesapeake Bay.

e are certain special regulations relating to ng for that part of the Chesapeake Bay known squehana Flats. Any owner of land bordering rea may, during October of each year, select nark any point on his shore for the purpose of ng and, immediately following such selection, ill have exclusive rights to hunt within one- er mile of the point so marked. Fishing with and line in certain areas is prohibited during egular duckling season, except that fishing is ed on Sundays during this period. (Johnson-

08492

ERY V REEVES (EASEMENT FOR IR- TION CANAL).

o 2d 64-67 (La Ct App 1959).

Descriptors: *Louisiana, *Irrigation canals, *Canal construction, *Right-of-way, Easements, Irrigation, Judicial decisions, Boundary disputes, Water wells, Water rights, Water utilization, Alteration of flow, Relative rights, Land use.

This was a slander of title action to compel cancellation of a right-of-way granted by plaintiff landowner for canal purposes to defendant's predecessor. In consideration for the right-of-way defendant's predecessor was to construct a canal from which plaintiff had the right to draw water for irrigation. The deed provided for automatic termination of the right-of-way if not used for canal purposes for three consecutive years. Plaintiff contends the right-of-way terminated because in 1945 defendant's predecessor abandoned operation of the canal system insofar as plaintiff's land to the north was concerned and that defendant's use of the canal for his own private purposes was not such a use as to prevent termination. The court held that defendant's predecessor had the express right to convey the right-of-way to defendant and that there was no restriction that the canal be used to carry water from any specified source or be used only in conjunction with the entire canal system. Although plaintiff, having constructed an irrigation well, no longer used the canal for irrigation the deed reflected no intention that the right-of-way should cease when he no longer benefitted. Judgment was for defendant. (Kahle-Fla)
W69-08538

STATE V BENTLEY (WATER DAMAGE).
71 NW 2d 780-787 (Minn 1955).

Descriptors: *Minnesota, *Eminent domain, *Water control, *Projects, Project planning, Water policy, Project purposes, Competing uses, Project benefits, Public rights, Condemnation, Condemnation value, Judicial decisions, Legal aspects, Water distribution (Applied), Water law, Water resources, Compensation, Flow augmentation, Channel improvement, Damages.

Plaintiff landowners intervened in condemnation proceedings instituted pursuant to Minnesota statutes which authorized water control projects. Plaintiffs claimed that their lands had been damaged by an increased volume of water flowage created by the water control projects. Plaintiffs' petition was denied by the district court and an appeal was taken to the Minnesota Supreme Court. The water control projects involved here consisted of widening and deepening existing channels and constructing dams and dikes on certain lakes. The supreme court held that the water control projects did no more damage to plaintiffs' lands than would have occurred in the same manner in a state of nature and that plaintiffs' lands had not been taken, damaged or destroyed by the state of Minnesota so as to justify compensation in an eminent domain proceeding. (Carruthers-Fla)
W69-08566

BOROUGH OF WINDBER V SPADAFORA (CONSTRUCTION EXTENDING INTO NON-NAVIGABLE WATER).
356 Pa 130, 51 A2d 726-730 (1947).

Descriptors: *Pennsylvania, *Non-navigable waters, *Riparian rights, *Streamflow, Damages, Local government, Cities, Legislation, Alteration of flow, Obstruction to flow, Floods, Riparian waters, Downstream, Administrative agencies, Streambeds, Legal aspects, Permits, Relative rights, Repairing.
Identifiers: Injunctions (Mandatory), Injunctions (Prohibitory).

Defendant owned riparian land on a stream within plaintiff borough. She erected a building on her lot and projected the foundation wall into the stream without a permit, as required, from the Water and Power Resources Board. The structure had been partially washed away and defendant expressed her intent to repair it despite being refused a permit by the Board. Plaintiff alleged the structure narrowed the stream causing downstream flood damage and asked an injunction to restrain the rebuilding of the structure and to require the removal of the encroaching portion. The Board joined as an intervener. The court held that a riparian owner on a non-navigable stream may construct anything he pleases to the thread of the stream unless it injures the public. The borough could not complain except to the extent the public rights were affected. The injunction to require removal of the structure was denied because of the borough's failure to prove injury to the public and because of the borough's long delay in seeking the injunction. The injunction, prohibited defendant from repairing her wall until a permit was issued; however, the injunction was granted because of the statutory requirement to obtain a permit. (Helwig-Fla)
W69-08567

UNITED STATES V LOUISIANA (SUIT BY FEDERAL GOVERNMENT AGAINST STATE TO DETERMINE CONTROL OF AREA OUTSIDE 3 MILE BELT).

339 US 699-706 (1950).

Descriptors: *Louisiana, *Federal jurisdiction, *Ownership of beds, *Federal-state water rights conflicts, State jurisdiction, Low water mark, Shores, Oceans, Gulf of Mexico, Beds under water, Tidal waters, Federal government, Boundary disputes, Minerology, Legal aspects, Judicial decisions, Treaties, United States.
Identifiers: *Three mile belt, Injunction.

The federal government alleged that all lands, minerals, and other things lying seaward of the ordinary low water mark on the coast of Louisiana and outside the inland waters were in the full domain and power of the United States government. They sought a decree adjudging and declaring the rights of the federal government in this area as against Louisiana, enjoining all others against trespass. Louisiana alleged that the federal government had claim to only those beds of the Gulf of Mexico to the extent of powers existing under the constitution, laws and treaties of the United States, none of which would affect the area herein concerned. Basing their decision on United States v California, 332 US 19, which held that the three mile belt of the shore was in the domain of the United States rather than the separate states, the Supreme Court reasoned that it would follow a fortiori that the area claimed by Louisiana extending 24 miles seaward beyond the three mile limit was also within the domain of the United States rather than that of Louisiana. (Logan-Fla)
W69-08597

6G. Ecologic Impact of Water Development

AN ECOLOGICAL AND RECREATIONAL USE SURVEY OF THE LUXAPALILA RIVER,
Mississippi State Univ., State College. Dept. of Wildlife Management.
Dale H. Arner, Warren G. Anding, William Lunceford, and Charles Summerour.
Completion Report, Mississippi State Water Resources Research Institute, June, 1969. 48 p. OWRR Project A-029-MISS.

Descriptors: *Ecology, *Recreation, Invertebrates.
Identifiers: Luxapalila River (Miss).

An ecological and recreational use survey was made of the Luxapalila River in Mississippi. This study was made before channelization work was started by the Army Corps of Engineers. A follow-up ecological study is planned after channelization work is completed. Four stations located along a 10.5 mile stretch of river were selected for making certain chemical and biological measurements. The study was started in July, 1968, and concluded in June, 1969. Results of this study revealed that the

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Luxapalila River is rich in species of fish with 37 different species recorded. Collections of invertebrates were made over a period of 12 months by sweep netting and with square foot bottom samplers. The largest standing crop of 1.93 lbs. per acre (oven dry weight) was collected in September, and the smallest standing crop, 0.01 lbs. per acre, was found in December. Water chemistry and both air and water temperatures were recorded. The information obtained was characteristic of that from similar streams. Water table levels were measured at selected distances adjacent to the river. A survey of recreational use of the river was made, and it revealed that fishing was the major use (59 percent), FOLLOWED BY SWIMMING (28 percent). Ninety-five percent of the recreational parties interviewed were residents of the area, and most (83 percent) of these parties traveled less than 16 miles round trip to visit the river. Inaccessibility to the river due to private land holdings is believed to be a major factor in the small recreational use made of this river.
W69-08399

07. RESOURCES DATA

7A. Network Design

THEORETICAL STREAM LENGTHS AND DRAINAGE AREAS IN HORTON NETS OF VARIOUS ORDERS,
Illinois Univ., Urbana; and Illinois Univ., Champaign.
K. H. Liao, and A. E. Scheidegger.
Water Resources Res, Vol 5, No 3, pp 744-746, June 1969. 3 p, 1 tab, 9 ref.

Descriptors: *Drainage patterns (Geologic), *Statistical models, Drainage density, Tributaries, Drainage systems, Geomorphology, Networks.
Identifiers: Strahler stream orders, Horton stream orders.

Tables of expected stream lengths and drainage areas of Strahler streams are presented for various orders for networks with various numbers of first-order streams. The values are based on a random-graph stream-network model. (Knapp-USGS)
W69-08211

THE ASSISTANCE OF DIGITAL COMPUTERS IN HYDROLOGIC RESEARCH AND ITS CONSEQUENCES,
Agricultural Research Service, Tucson, Ariz. Southwest Watershed Research Center.
D. L. Chery, Jr.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Int Ass Sci Hydrol, Pub No 80, Vol 1, pp 198-202, 1968. 5 p, 26 ref.

Descriptors: *Hydrologic data, *Data processing, *Digital computers, Data storage and retrieval, Data collections, Data transmission, Instrumentation, Telemetry, Remote sensing, Research and development, Hydrology.
Identifiers: Data analysis.

The digital computer is now an indispensable tool in the processing of hydrologic data. Further, it has become an indispensable assistance in the analysis of collected data and information. The ultimate consequence of this assistance will be the direct interfacing of computers with the experiment. Immediate consequences of the presence of computers are the need to reduce to digital form great masses of accumulated records; the reconsideration of experimental designs; the development of improved instrumentation and data acquisition systems; and the adjustment in thinking to realize the potential of computer assistance. (Knapp-USGS)
W69-08233

WATER RESOURCES INVESTIGATION IN A SEMIARID BASIN IN ARIZONA, U.S.A.,
Geological Survey, Tucson, Ariz. Water Resources Div.
For primary bibliographic entry see Field 02F.
W69-08299

A HYDROLOGICAL SYNTHESIS OF THE CHAD BASIN,
Food and Agriculture Organization of the United Nations. Chad Basin Commission.
C. E. Gischler.
Nature and Resourc, Vol 3, No 3, pp 9-15, 1967. 7 p.

Descriptors: *Synthesis, *Hydrologic data, Lake basins, Geomorphology, Arid lands, Maps, Hydrography, Large watersheds, Groundwater, River basins, Electric analog models, Aquifers, Salinity, Hydrogeology, Hydrological aspects, Administrative agencies, Coordination, Project purposes, United Nations, Water resources development, Radioisotopes, Stable isotopes.
Identifiers: Cameroon Republic, *Lake Chad Basin, Unesco, Chad Republic, Federation of Nigeria, Niger Republic.

This paper reports on studies and projects important to the Unesco hydrological synthesis of information on the Lake Chad basin, and on activities of the Unesco team. A short history is presented of the development of international cooperation in this four nation basin; Chad Republic, Federation of Nigeria, Niger Republic, Cameroon Republic. A review of the important research activities and publications concerning cartography, geology, pedology and hydrology of each country shows them to have been abundant and often very complete. The coordinating program of Unesco has as objectives: (1) acting as intermediary between governmental and scientific institutions, (2) coordination of present and future activities, (3) correlation of existing reports and maps, and (4) arbitration of criteria of the synthesis for utilization in formulating an analogue model. Present programs reported on include phreatic water studies in Nigeria and stable and unstable isotope investigations. (Sherbrooke-Ariz)
W69-08304

AN APPLICATION OF MULTIVARIATE ANALYSIS TO SEDIMENT NETWORK DESIGN,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
James R. Wallis, and Henry W. Anderson.
Int Ass of Sci Hydrology, No 67 (1965): 357-378.

Descriptors: *Analytical methods, *Sediment yield, *Hydrologic data, Project planning, Sampling, Regression analysis, Environmental effects, California.
Identifiers: Principal components analysis, Network design.

Most stream sedimentation stations are selected to answer the simple question, 'What sedimentation problem would confront a structure installed at this site today.' A network of sedimentation stations resulting from repeated application of this criterion will almost certainly be unsatisfactory for answering problems in sedimentation research and may often be unsatisfactory for answering the simple needs for structural design and evaluation. Analysis of the existing northern California suspended sediment data suggests that for some stations the number of sediment samples taken could be greatly reduced without impairing the accuracy of predicted sediment yield, and that in addition samples need to be taken on other watersheds. Network design should be kept flexible so as to meet changing sediment discharges from watersheds. An 11-step procedure is given which could be used for designing a sediment network to yield the maximum of useful information. An equation relating sediment discharge to changing watershed variables of forest fires, unimproved roads, logging of forests and conversion of forests to grasslands was developed by regressing on principal components.
W69-08497

RANDOM WALK AND RANDOM ROUGH MODELS OF DRAINAGE NETWORKS,
Technion - Israel Inst. of Tech., Haifa. Dep Agricultural Engineering.
For primary bibliographic entry see Field 02E.
W69-08571

SYSTEMATIC VARIATION PATTERN OF NUAL RIVER FLOWS,
Melbourne Univ., Parkville (Australia). Dep Engineering; and Scott and Furphy, Melbo (Australia).
For primary bibliographic entry see Field 02E.
W69-08591

HYDROLOGIC DATA SYSTEMS--DEVE ING CONCEPTS,
Geological Survey, Washington, D. C.
E. L. Hendricks.
Proc 41st Annu Conv Western State Eng, Sep 13, 1968, Jackson Lake, Wyo, p 64-66, 1969.

Descriptors: *Data collections, *Hydrologic Networks, Governments, State governments, storage and retrieval, Data processing.
Identifiers: U S Geological Survey, Water acquisition.

Water-related activities in the United State clude hydrologic-data collection, planning, gineering, construction, water allocation and ministration, etc. At thousands of points deci are made which involve the use of water data tain water-data elements are the common stituents for the inputs to many of these dec points--that is, water data in general are subje multiple uses. The water-data activity of Geological Survey was founded on the princ probably never precisely enunciated--that, i public interest, the water-data base common many uses should be collected by one agenc tionally oriented and capable of maintai uniform and acceptable standards of accu throughout the Nation. The Bureau of the Bu Circular No. A-67, which provides for the dination of water-data acquisition activities o Federal agencies, starts from an assumption t single agency not only should coordinate thes tivities but also should design the 'National work' and be largely responsible for implem tion of that part of the optimum data-acquis program which constitutes the common data required by several agencies. The Departme the Interior enunciated a similar thesis where Geological Survey should provide the basic w data needs for the entire Department. (USGS)
W69-08606

7B. Data Acquisition

A SIMPLE SNOWMELT LYSIMETER,
Forest Service (USDA), Ogden, Utah. Intern tain Forest and Range Experiment Station.
For primary bibliographic entry see Field 02C.
W69-08206

COMPARISON BETWEEN RAIN GAGE LYSIMETER MEASUREMENTS.
California Univ., Davis. Dept. of Water Sc and Engineering.
For primary bibliographic entry see Field 02B.
W69-08208

TRACING GROUNDWATER WITH CHLO IONS AND TRITIUM THROUGH KAOLINITIC SOIL,
Du Pont de Nemours (E. I.) and Co., Aiken, Savannah River Lab.
For primary bibliographic entry see Field 02F.
W69-08286

APPLICATION OF GEOELECTRICAL
ODS FOR GROUND-WATER EXPLORA-
OF UNCONSOLIDATED FORMATIONS
II-ARID AREAS,
Univ. (Yugoslavia). Geophysical Inst.
ir Krulc, and Milovan Mladenovic.
tl Assoc Hydrogeol, Congress of Istanbul,
Memoir 8, pp 441-449, 1968. 9 p, 8 fig, 36

tors: *Aquifer characteristics, *Arid lands,
, Depth, Hydrology, Surface water, Semi-
mates, Saline water.
ers: *Geoelectrical profile, *Geoelectrical
g, Egypt, Libya.

ention of this paper is to indicate the possi-
and limitations of geoelectrical methods in
-water exploration of unconsolidated forma-
arid or semi-arid regions (Egypt, Libya),
larly where great areas are covered by
read superficial deposits. By use of resistivi-
niques -- geoelectrical sounding and profil-
it is possible to solve problems on the
tion of saline water into the dry land, the
ion of fresh lenses floating on saline water,
termination of the thickness of alluvial
, and the establishment of the depth of
mpermeable basement. By the geoelectrical
ng method, a hydrogeological cross section
ined at measureing points as well as the data
ning the depth of single horizons in un-
und. In this way the vertical geoelectrical
ng replaces exploration drilling to a certain
. (Sherbrooke-Ariz)
8297

SYSTEMS AND INFORMATION
IEVAL ADAPTABLE TO WATER
URCES,
mic Research Service, Washington, D.C.
rce Data Systems Group.
mary bibliographic entry see Field 10.
8389

RECLASSIC WATER DISTRIBUTION
EM IN AMALUCAN, MEXICO,
nsin Univ., Milwaukee.
L. Fowler.
eology, Vol 22, No 3, p 208-215, June 1969.
ust.

ptors: *Distribution systems, *Soil profiles,
eyance structures, Soil structure, Irrigation
Water supply, Aerial photography.
iers: *Mexico, *History of technology,
eology.

d investigation, based upon aerial photoin-
tation, was made of an archaeological zone
st of the city of Puebla, state of Puebla, Mex-
is zone consists of two hills on a gently slop-
ain with groups of pyramids or mounds on
he plain and one of the hills. Ground recon-
nce revealed man-made disturbance of the
ng a straight line alignment first identified in
rial photographs. Stratigraphic cuts were
in the disturbed areas in three meter square
or an area of thirty by three meters. These
uares were expanded to form a thirty meter
rench. Two soil profiles of this area are illus-
Schematic cross-secions show the probable
nce of channel changes in the system caused
sion and sedimentation which occurred dur-
e. Probable use of the system for water supply
gation purposes is discussed. From radiocar-
ating of organic materials in a nearby mound,
had ceramics similar to those found in a
d constructed over a part of the system, the
the system is estimated to be earlier than 200
08396

A SHIELDED THERMISTOR WITH PORTABLE INSTRUMENT FOR MEASURING SNOWPACK TEMPERATURES,
Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
G. J. Gottfried, and C. J. Campbell.
USDA Forest Serv Res Note RM-120, (1968). 3 p.

Descriptors: *Instrumentation, *Snowpacks, *Temperature, Thermocline.
Identifiers: *Thermistor, *Snowpack temperature.

A phenol-resin-based shield has been developed to protect a thermistor probe that can be inserted into a snowpack. With the probe and wheatstone bridge circuit temperatures can be measured within the snowpack to 0.1 degree C.
W69-08469

STREAMFLOW VOLUMES AND HYDROGRAPHS BY FLUORESCENT DYES,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
B. C. Goodell, J. P. C. Watt, and T. M. Zorich.
Int Un of Forestry Res Organizations, 14th IUFRO Congress, 1967, (v. 1, Sect. 11): 325-348.

Descriptors: *Stream gages, Gaging stations, Hydrographs, Hydrometry, Tracers, Instrumentation, Fluorescence, Flow rates, Flow measurement, Flow, Fluorometry.
Identifiers: Stream flow gaging.

Two new methods of streamflow gaging are under development. Each employs the principle of dilution of fluorescent dye Rodamine WT. In each, a concentrated dye solution is injected at a constant low rate into stream from a Mariotte vessel of refined design. In one, small, discrete samples of the dosed stream are accumulated in a storage vessel. Sampling is at a stream point where mixing is complete and accomplished by a simple siphon device operating at a constant time cycle. Fluorometric analysis of a sample from the storage vessel following a week's accumulation enables calculation of weekly average rate of streamflow with useful accuracy if discharge fluctuations during week are moderate. In the other method, a small continuous diversion from the dosed stream is brought into contact with a clock-driven strip of commercially available gelatin-coated film. Dye is sorbed by the gelatin proportionately to its concentration. Laboratory analysis of the film by a specially modified fluorometer yields a hydrograph of the stream. This method is not limited to moderately fluctuating streams. Both methods are particularly designed for use on mountain streams where access is difficult and many years of record unnecessary. Development is continuing.
W69-08480

USE OF NUCLEAR TECHNIQUES IN SNOW AND RELATED WATERSHED MANAGEMENT,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
James L. Smith.
Trans American Nuclear Society 10 (1): 78, 1601, 1967. 1 p.

Descriptors: *Snow, *Density stratification, Watershed management, Snowmelt, Snow management, Hydrologic aspects.
Identifiers: *Snow density, *Density profiles, *Snow hydrology.

Snow density profiles taken under natural snowmelt and under the impact of rain falling on snow show some current snow hydrology concepts to be inaccurate.
W69-08496

MULTIVARIATE STATISTICAL METHODS IN HYDROLOGY-A COMPARISON USING DATA OF KNOWN FUNCTIONAL RELATIONSHIP,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
James R. Wallis.
Water Resources Research, Vol 1, No 4 (1965): 447-461.

Descriptors: *Estimating equations, *Forecasting, *Analytical methods, *Regression analysis, Statistical models, Mathematical models, Mathematical studies, Hydrologic aspects.
Identifiers: Factor analysis, Principal components analysis, Key cluster analysis, Multivariate analysis.

Conventionally hydrologists have used regression analysis for solving their multivariate problems. Recently other multivariate statistical methods have been advocated. This paper discusses and compares the effectiveness of six methods of analysis: regression, principal component, varimax, oblimax, key cluster, and object. Strengths and weaknesses of each method are discussed and the combination of principal component regression with varimax rotation of the factor weight matrix is recommended for an initial analysis of multifactor hydrologic problems.
W69-08499

WATERSHED MODELING APPROACH TO EVALUATION OF THE HYDROLOGIC POTENTIAL OF UNIT AREAS,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 02A.
W69-08504

GENERAL REPORT SYMPOSIUM SUBJECT: NEW IDEAS AND SCIENTIFIC METHODS IN STOCHASTIC (STATISTICAL) HYDROLOGY,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Henry W. Anderson.
Int Hydrol Symp Proc (1967): 322-335, Colorado State University, Fort Collins, Colo.

Descriptors: *Reviews, *Statistical methods, Regression analysis, Frequency analysis, Mathematical models, Mathematical studies, Hydrologic aspects.
Identifiers: Multivariate analysis, Baysian Theory, Principal components, Gamma distributions.

Summarizes, critically reviews and expands on the contents of eight papers on stochastic (statistical) hydrology. Subjects included were Baysian Theory, multivariate analysis, gamma distributions, and applications of the theory of runs.
W69-08505

WHEN IS IT SAFE TO EXTEND A PREDICTION EQUATION--AN ANSWER BASED UPON FACTOR AND DISCRIMINANT FUNCTION ANALYSIS,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
James R. Wallis.
Water Resources Research, Vol 3, No 2, (1967): 375-384.

Descriptors: *Statistical methods, *Forecasting, *Regression analysis, Environmental effects, Sediment yield, Sedimentary petrology.
Identifiers: *Principal components analysis, Linear discriminant functions, Watershed variables.

Prediction equations for hydrologic events developed from one population of observations (watersheds) are often solved for another population that is removed either in time or in space. Predictions of this kind are never certainties, although some predictions are obviously more uncertain than others. This paper proposes an empirical uncertainty classification that may be found useful for separating probably successful from probably unsuccessful extensions of prediction equations. The classification system is illustrated by a prediction equation for suspended sediment discharge developed from some watersheds in California, and by a discriminant function for marine versus nonmarine sediments based upon microelements.
W69-08509

LIBRARY U. OF L. URBANA-CHAMPAIGN

DETERMINATION OF FEEDING CHRONOLOGY IN FISHES,
Marquette Univ., Milwaukee, Wis. Dept of Biology.
For primary bibliographic entry see Field 05C.
W69-08514

ECONOMIC EVALUATION OF RESERVOIR SYSTEM ACCOMPLISHMENTS,
Corps of Engineers, Sacramento, Calif. Hydrologic Engineering Center.
For primary bibliographic entry see Field 06B.
W69-08543

DETERMINATION OF TOTAL NITROGEN IN WATER BY MICROCOULOMETRIC TITRATION,
Dohrmann Instruments Co., Mountain View, Calif.
For primary bibliographic entry see Field 05A.
W69-08559

AN INEXPENSIVE RECORDING SETTLING TUBE FOR ANALYSIS OF SANDS,
University of Southern California, Los Angeles.
David W. Felix.
J Sediment Petrol, Vol 39, No 2, pp 777-780, June 1969. 4 p, 4 fig, 1 tab. USGS Contract No 14-08-0001-10862.

Descriptors: *Particle size, *Settling velocity, *Instrumentation, Sieve analysis, Deposition (Sediments), Analytical techniques, Laboratory tests, Calibrations.
Identifiers: Settling tube, Particle size analysis.

An automatically recording settling tube for rapid size analysis of sand can be constructed from Plexiglas tubing, a transducing cell, and a small chart recorder for less than $1100 (1968 prices). It eliminates time consuming processes associated with sieving, and yields data in terms of hydraulic equivalent size. Reproducibility of the arithmetic mean averages 0.09% for several replicate samples. This compares with 1.0% for sieves, and 5% for the Emery Tube. (Knapp-USGS)
W69-08582

CALIBRATION OF THE UNIVERSITY OF SOUTHERN CALIFORNIA AUTOMATICALLY RECORDING SETTLING TUBE,
University of Southern California, Los Angeles. Dept. of Biology.
David O. Cook.
J Sediment Petrol, Vol 39, No 2, pp 781-786, June 1969. 6 p, 5 fig, 2 tab, 9 ref. USGS Contract 14-08-0001-10862.

Descriptors: *Particle size, *Settling velocity, *Instrumentation, *Calibrations, Sieve analysis, Analytical techniques, Laboratory tests.
Identifiers: Settling tube calibration, Particle size analysis.

Calibration of the automatically recording settling tube at the University of Southern California is done by using small groups of glass beads. The settling times are adjusted to a specific gravity of 2.65 and the calibration extrapolated for different temperatures. The calibration does not compensate for interaction among settling grains, but this factor may significantly influence the deposition of aqueous sands. The range of calibration and laboratory error for the settling tube is small compared to the textural variation of natural sands. (Knapp-USGS)
W69-08583

A CONTACT GAGE FOR RAPID AND ACCURAGE THREE-DIMENSIONAL GRAIN SIZE MEASUREMENT OF LOOSE SAND PARTICLES,
Pennsylvania State Univ., University Park. Dept. of Geology and Geophysics; and National Iranian Oil Co., New York.
Hassan G. Modarresi.
J Sediment Petrol, Vol 39, No 2, pp 793-797, June 1969. 5 p, 2 fig, 11 ref.

Descriptors: *Particle shape, *Particle size, *Measurement, *Instrumentation, Sedimentology, Laboratory tests, Evaluation, Dimensions, Test procedures.
Identifiers: Particle shape analysis, C-axis length (Grains).

Previous methods for evaluating the c-axis (shortest dimension) of sand-sized particles have proven impractical and have not been widely utilized. This paper describes a new method which permits rapid and accurate c-axis measurement of numbers of sand grains. With this technique, sand samples can be simply and efficiently sorted according to c-axis values. (Knapp-USGS)
W69-08584

A RAPID METHOD FOR THE DETERMINATION OF SHAPE, SPHERICITY AND SIZE OF GRAVEL FRAGMENTS,
Ibadan Univ. (Nigeria). Dept. of Geology.
Kevin Burke, and S. J. Freeth.
J Sediment Petrol, Vol 39, No 2, pp 797-798, June 1969. 2 p, 3 fig, 2 ref.

Descriptors: *Gravels, *Particle shape, *Particle size, *Instrumentation, *Measurement, Sedimentology, Laboratory tests, Estimating, Dimensions, Test procedures.
Identifiers: Overhead transparency projectors.

The lengths of the 3 major axes of gravel fragments can be determined by placing the fragments over a grid on an overhead projector of the type found in most modern lecture theatres. The particles are spread on sheets of transparent graph paper with their major and intermediate axes approximately parallel to the surface. The minor axis is determined by rotating the particle around its major axis until the smallest projected area is seen. The accuracy is about 1/4 mm. (Knapp-USGS)
W69-08585

7C. Evaluation, Processing and Publication

ON A METHOD OF FLOOD FORECASTING USING A DIGITAL COMPUTER CONNECTED WITH A WEATHER RADAR,
National Research Center for Disaster Prevention, Tokyo (Japan).
For primary bibliographic entry see Field 02A.
W69-08229

A COMPARATIVE ANALYSIS OF DIGITAL AND ANALOG COMPUTERS AS TO THEIR EFFECTIVENESS IN SOLVING RUNOFF ANALYSIS,
National Research Center for Disaster Prevention, Tokyo (Japan).
For primary bibliographic entry see Field 02A.
W69-08230

ON THE SOLUTION OF THE PROBLEMS OF INFILTRATION WITH THE AID OF ELECTRONIC COMPUTERS (FRENCH),
Institute of Hydrotechnical Research, Bucharest (Rumania).
For primary bibliographic entry see Field 02G.
W69-08231

SOME REMARKS ON THE USE OF DIGITAL COMPUTERS AND HYDRAULIC METHODS FOR FLOOD ROUTING AND FLOOD FORECASTING PROBLEMS,
Institute of Hydrotechnical Research, Bucharest (Rumania).
For primary bibliographic entry see Field 02E.
W69-08232

THE ASSISTANCE OF DIGITAL COMPU IN HYDROLOGIC RESEARCH AND ITS SEQUENCES,
Agricultural Research Service, Tucson, Southwest Watershed Research Center.
For primary bibliographic entry see Field 07A
W69-08233

DIGITAL-COMPUTER APPLICATIONS CHEMICAL-QUALITY STUDIES OF SUR WATER IN A SMALL WATERSHED,
Geological Survey, Washington, D. C.
Timothy Steele.
Symp on Use of Analog and Digital Comput Hydrol, Tucson, Ariz, Dec 1968, Int As Hydrol, Pub No 80, Vol 1, pp 203-214, 1968. 4 fig, 2 tab, 6 ref.

Descriptors: *Water quality, *Water chem *Small watersheds, *Sampling, *Digital comp Data processing, Data storage and retrieval, ous solutions, Leaching, Weathering, Solutes flow.
Identifiers: San Francisco (Calif).

A program of sampling surface water and ana for the major ionic constituents was carrie over a 15-mo period between June 1966 an tober 1967, in the Pescadero Creek wate California. The 46-sq mi coastal basin, about south of San Francisco, is relatively free of h habitation and agriculture, but geologically plex. Chemical-quality data from the wate despite its complex geology, showed cons relations with specific conductance. Simple r sion equations were developed by graphic analytical methods, to form the basis of a d computer program for estimating solute conc tions and loads from discharge data alone. solute concentrations were plotted against stream discharge, trends were consistently throughout the range of discharges for Na, K Cl concentrations, but a characteristic bre trends from low to high discharges was d discernible for Ca, Mg, bicarbonate, sulfate calculated dissolved-solids concentrations may result from the different chemical proc that prevail during base flow under predomi direct-runoff flow. The linear trends are part plained by the increasing solute contributio groundwater in the lower part of the wate Concentrations-discharge regression equa were derived for the base-flow component a the direct-runoff component. Relative propo of solute concentrations contributing to specific conductance changed rather abruptly low- to high-discharge levels. High specific ductances reflected larger percentage con tions by Na and Cl ions and corresponding st contributions by Ca and sulfate ions. The app and methods used in this study might be ext to other small watersheds quite different in ge and climatology in search of correct quanti interpretation and prediction of the effec hydrochemical processes in nature.
W69-08234

CALIFORNIA'S DIGITAL COMPUTER PROACH TO GROUNDWATER MANAGEMENT STUDIES,
California State Dept. of Water Resources.
For primary bibliographic entry see Field 04B
W69-08235

PREPARATION, VERIFICATION AND US A DIGITAL GROUNDWATER SIMULA PROGRAM,
General Electric Co., Santa Barbara, Calif. PO.
David Kleinecke.
Symp on Use of Analog and Digital Compu Hydrol, Tucson, Ariz, Dec 1968, Int A Hydrol, Pub No 80, Vol 1, pp 224-232, 1968 fig, 5 ref.

criptors: *Mathematical models, *Digital computers, *Analog computers, *Synthetic hydrology, oundwater basins, Water levels, Water-level uations, Model studies, Aquifers.
tifiers: *Hybrid computers.

digital computer programs TELMA 1 and MA 2 written at General Electric TEMPO for imulation of groundwater basins are described. e programs have some features of interest not lable in other digital simulation programs. Exence in attempting to verify the groundwater in an actual basin using TELMA 1 is ented. Available data, both geohydrological concerning historic recharge and production, be supplemented most effectively by using a lation model to guide the collection of new ination. The existing data can be much more ningfully and economically utilized by inucing mathematical optimization techniques as id in model building. This approach assumes nsive use of digital computation in the preparaof models but does not preclude the possibility nalog or digital-analog hybrid computers after uate models have been developed. It is coned that simulation is the only practical way to utilize present data and guide the develop- of better understanding of groundwater flows for direct management purposes and as a ns of improving geohydrological knowledge. app-USGS)
-08236

LICATIONS OF COMPUTER TECHNOLO-TO HYDROLOGIC MODEL BUILDING,
cultural Research Service, Chickasha, Okla. thern Plains Branch.
n G. De Coursey.
p on Use of Analog and Digital Computers in rol, Tucson, Ariz, Dec 1968, Int Ass Sci rol, Pub No 80, Vol 1, pp 233-239, 1968. 7 p, 1 3 tab, 8 ref.

criptors: *Computer programs, *Digital comrs, *Optimization, *Mathematical models, rology, Systems analysis, Parametric hydrolo- Streamflow, Discharge (Water), Stage-harge relations, Data processing.
tifiers: Optimization program.

optimization program useful in hydrologic leling is described. Conceptual and rational rologic models of non-linear form are ussed. Several have implicit components. A explanatory and easy program is used to find mum values of the coefficients. (Knapp-USGS)
-08237

IGITAL COMPUTER PROGRAM TO PLOT HYETAL MAPS AND CALCULATE LUMES OF PRECIPITATION,
h Water Research Lab., Logan.
n Y. Kwan, J. Paul Riley, and Roger A. Amisial.
p on Use of Analog and Digital Computers in rol, Tucson, Ariz, Dec 1968, Int Ass Sci rol, Pub No 80, Vol 1, pp 240-248, 1968. 9 p, 6 l tab.

criptors: *Computer programs, *Rainfall osition, *Mapping, *Distribution patterns, hyets, Contours, Weather data, Data cessing, Rainfall.
tifiers: Rainfall data plotting.

ortran IV program has been developed to plot yetal lines from precipitation data of given sta-s. Points on the isohyetal lines are determined inear interpolation between stations. Once the yetal points were obtained, their proper ience was determined. This was performed by ing with a certain point and checking the ts successively nearest to it for a permissible ection between the two points. Then the ience of points was checked for possible loop-or connection with other sequences of points of same precipitation. The isohyetal lines were smoothed by successive parabolic approximations. Volume of precipitation can be calculated within any specified boundary. It is possible to calculate volumes of precipitation over sub-zones of a given area. The volume is obtained by summing the product of the area between two precipitation lines and the average precipitation value of the lines. The area between the isohyetal lines is found by dividing the region into straight line trapezoidal segments and summing the areas of the trapezoids. (Knapp-USGS)
W69-08238

HYPOTHETICAL FLOOD COMPUTATION FOR A STREAM SYSTEM,
Corps of Engineers, Sacramento, Calif. Hydrologic Engineering Center.
Leo R. Beard.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Int Ass Sci Hydrol, Pub No 80, Vol 1, pp 258-267, 1968. 10 p, 4 fig, 1 tab.

Descriptors: *Routing, *Flood forecasting, *Computer programs, Runoff forecasting, Synthetic hydrology, Snowpacks, Snowmelt, Water loss, Hydrograph analysis, Regulation, Urbanization, Rainfall-runoff relationships.
Identifiers: U.S. Army Corps of Engineers.

One of the computer packages being developed in The Hydrologic Engineering Center of the Corps of Engineers is the Flood Hydrograph Package, which performs all common operations in deriving and using flood hydrographs entirely in core storage of computers as large as the IBM 7094. One of the problems managed by this program is flood computation throughout an entire stream system in one operation. Ordinarily, a design or hypothetical flood might be derived from a storm centered in the tributary area. After floods are computed in this manner for several subareas within a stream system, it is often necessary to compute floods for the combined areas at various locations. The originally computed floods cannot be routed and combined, since the storm cannot center over all subareas at once. It is ordinarily necessary to recompute each subarea flood for every combining point downstream, and to label each recomputation as the contribution to that particular location. In a complex system, such as a storm drain or major river basin, this procedure would lead to great amounts of computation and considerable confusion. Essential features of the computer package and the simplified stream system analysis are described. (Knapp-USGS)
W69-08239

APPLICATION OF COMPUTERIZED OPERATIONS RESEARCH TECHNIQUE FOR OPTIMUM ECONOMIC SIZING OF THE MIDDLE FORK EEL RIVER PROJECT,
California State Dept. of Water Resources. Advanced Techniques Section.
For primary bibliographic entry see Field 06A.
W69-08240

SOME PROBLEMS OF STREAMFLOW FORECASTS BASED ON INFORMATION THEORY,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 02E.
W69-08241

DIGITAL COMPUTER APPLICATIONS TO GREAT LAKES REGULATION,
Department of Energy, Mines and Resources, Ottawa (Ontario); and McGill Univ., Montreal (Quebec).
R. L. Pentland, A. B. Rosenberg, and G. S. Cavadias.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Int Ass Sci Hydrol, Pub No 80, Vol 1, pp 289-299, 1968. 11 p, 5 fig, 6 ref.

Descriptors: *Great Lakes, *Water levels, *Water-level fluctuations, *Regulation, *Digital computers, Data processing, Mathematical models, Model studies, Computer models, Economics, Optimization, Systems analysis, Operations research.
Identifiers: Great Lakes regulation, Canada, United States.

The regulation of one or more of the Great Lakes has been under investigation sporadically for over 50 years by various agencies in Canada and the United States. Only in the last 3 years, however, in an international investigation, has the development and use of computers permitted study of many alternative regulations schemes utilizing all of the lakes while computing economic effects on the diverse interests. The various computer programs used in obtaining the material flow-level model and in deriving and testing forecasting and simulation techniques are discussed. Methodology as applied to the determination of economic effects is also considered in optimizing alternative schemes of regulation. A study of great complexity can be performed within tight scheduling with proper balance of technical personnel and equipment. (Knapp-USGS)
W69-08242

AN OPERATIONAL SYSTEM FOR COMPUTER PREPARATION OF SHORT-TERM RIVER FORECASTS ON THE NORTH COAST OF CALIFORNIA,
Weather Bureau, Sacramento, Calif. River Forecast Center.
For primary bibliographic entry see Field 02A.
W69-08243

COMPUTATIONAL ANALYSES OF MOISTURE FLUX OVER NORTH AMERICA,
Travelers Research Center, Inc., Hartford, Conn.
For primary bibliographic entry see Field 02B.
W69-08244

OPERATIONAL STREAMFLOW FORECASTING WITH THE SSARR MODEL,
Weather Bureau, Portland, Oreg. River Forecast Center.
For primary bibliographic entry see Field 02E.
W69-08245

APPLICATION OF STREAMFLOW SYNTHESIS AND RESERVOIR REGULATION--'SSARR'--PROGRAM TO THE LOWER MEKONG RIVER,
Corps of Engineers, Portland, Oreg. North Pacific Div.
For primary bibliographic entry see Field 02E.
W69-08246

COMPUTER DOCUMENTATION AND RETRIEVAL OF HYDROLOGIC INFORMATION FOR SMALL GROUPS OR INDIVIDUALS,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Henry W. Anderson, and Theodore B. Yerke.
Int Ass Sci Hydrol Publ 81 (1968): 550-560.

Descriptors: *Information retrieval, *Bibliographies, *Publications, Research facilities, Computer programs, Automation, Data storage and retrieval, Hydrologic aspects.
Identifiers: Citations, Search, Abstracting, Computer aided documentation.

Computer programs have been developed which will allow the individual researcher, forester, or engineer to classify, store, and retrieve literature, abstracts, meeting notes etc. Use of one of the programs, the 'search program' in preparing a summary of sedimentation research in the U. S. is illustrated. Included is a discussion on what to document, indexing for information retrieval, and abstracting techniques. A list of 17 sources of keywords and descriptors of hydrologic and related terms is appendixed.
W69-08511

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SOME APPLICATIONS OF CROSS-SPECTRAL ANALYSES IN HYDROLOGY: RAINFALL AND RUNOFF,
Universidad Nacional del Zulia, Maracaibo (Venezuela); and Geological Survey, Fort Collins, Colo.
For primary bibliographic entry see Field 02A.
W69-08572

SUGGESTIONS ON COMPILATION OF SMALL SCALE HYDROGEOLOGICAL MAPS,
Sen So-yung.
Int Geol Rev, Vol 11, No 4, p 419-427, Apr 1969. 9 p, 16 ref, append. Transl from Acta Geol Sinica, Vol 45, No 3, pp 325-336, 1965.

Descriptors: *Hydrogeology, *Mapping, *Groundwater, *Surface waters, Distribution patterns, Hydrography, Surveys, Terrain analysis, Streams, Lakes, Aquifers, Water levels.
Identifiers: Hydrogeological maps, China.

Regional hydrogeological maps may be divided into 2 types, those expressing complex, and those expressing special factors. Complex small scale regional hydrogeological maps (1:1,000,000 and less) should expose the main features of regional hydrogeology, but also provide sufficient information to show concrete hydrogeological conditions. When distinguishing 'regional hydrogeological types,' we must take into account the geomorphological conditions, lithology and occurrence of aquifers, water quality, depth of underground water tables, underlying aquifers, special hydrogeological phenomena (salinization and swamping of soils, areas of artesian flow, etc.) and geological age or types of genesis of aquifers. Hydrogeological divisions include hydrogeological regions, subregions, terrains, and subterrains. The regional hydrogeological types are to be shown on the map by using different colors and tints and with various patterns as well; areas of hydrogeological divisions are to be traced only with boundary lines. (Knapp-USGS)
W69-08595

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 6. MISSOURI RIVER BASIN.
Geological Survey, Washington, D. C.

Geol Surv Water-Supply Pap No 1916, 1969. 800 p, 1 fig, 1 plate.

Descriptors: *Data collections, *Hydrologic data, *Water supply, *Missouri River, Montana, Wyoming, North Dakota, Streamflow, Discharge (Water), Gaging station, Stream gages, Surface waters.
Identifiers: *Missouri River Basin.

Records of stage, discharge, and content of lakes, streams, and reservoirs in the Missouri River Basin above Williston, North Dakota, 1961-1965, are compiled. The data are intended to be used to calculate water supplies for irrigation, municipal, industrial, and other uses. (Knapp-USGS)
W69-08605

GAMMA CORRELATION AND ITS USE IN COMPUTATIONS OF LONG-TERM STREAMFLOW REGULATION,
State Hydrological Inst., Leningrad (USSR).
Ye G. Blokhinov, and O. V. Sarmanov.
Soviet Hydrol: Selec Pap, Issue No 1, p 36-54, 1968. 19 p, 7 fig, 2 tab, 5 ref. From Trudy Gos Gidrol Inst, No 143, p 110-133, 1968.

Descriptors: *Statistical methods, *Correlation analysis, *Water management (Applied), Reservoir operation, *Reservoir design, Streamflow forecasting, Regulation.
Identifiers: *USSR, Gamma correlation.

The use of gamma distribution computation in correlating streamflow to make water management decisions is discussed. The main characteristics of a two-variate gamma distribution and working relationships needed for practical purposes are presented for a symmetric case, that is, when the values being correlated have the same parameters. The order in which the gamma correlation is used in computations of long-term streamflow regulation for selected major reservoir parameters is examined and an estimate is given of the possible water management effect obtained from its use. (Knapp-USGS)
W69-08612

PATTERNS OF SUCCESSION OF DRY AND WET YEARS AS A BASIS FOR COMPUTATIONS OF STREAMFLOW REGULATION,
State Hydrological Inst., Leningrad (USSR).
D. Ya. Ratkovich.
Soviet Hydrol: Selec Pap, Issue No 1, p 55-79, 1968. 25 p, 7 fig, 3 tab, 8 ref. From Trudy Gos Gidrol Inst, No 143, p 76-105, 1968.

Descriptors: *Statistical methods, *Correlation analysis, *Stochastic processes, *Markov processes, *Water management (Applied), Streamflow forecasting, Regulation, Reservoir operation.
Identifiers: Streamflow regulation.

The probability distribution of groups of various durations in limited samples of independent random values relative to some fixed value of a random quantity coincides with relationships characteristic of the population, provided the ends of a sample close circularly. This makes it possible to determine to what degree the results of water management computations, based on calendar series of hydrologic values, are free of systematic errors. The probability distribution depends on the number of terms in a sample and deviates more from relationships characteristic of the population in shorter samples. To verify the hypothesis that annual streamflow series can be regarded as sequences of independent random values, we must compare the distribution of groups of various duration in samples of independent random values with the recurrence of groups of dry and wet years actually observed in rivers. The distribution of groups of dry and wet years may differ from each other and differ in rivers that differ in flow formation conditions or belong to different physiographic regions. (Knapp-USGS)
W69-08613

SOME STATISTICAL METHODS IN THE ANALYSIS OF HYDROLOGIC SERIES,
State Hydrological Inst., Leningrad (USSR).
S. N. Kritskiy, and M. F. Menkel.
Soviet Hydrol: Selec Pap, Issue No 1, p 80-98, 1968. 19 p, 1 fig, 16 ref. From Trudy Gos Gidrol Inst, No 143, p 110-133, 1968.

Descriptors: *Statistical methods, *Correlation analysis, *Probability, *Streamflow forecasting, Sampling, Regression analysis, Parametric hydrology, Water management (Applied), Regulation, Markov processes, Stochastic processes.
Identifiers: Gamma distributions.

Some relationships between probability distribution parameters and method of estimating parameters that allow for the relatively small volume of samples and the correlation between contiguous terms are examined. The use of regression to reduce the characteristics of flow series to long-period values, the correlations between contiguous terms of simple Markov chains and their differences, and the refinement of formulas of standard errors in a sample estimate of the parameters of a gamma distribution are discussed. (Knapp-USGS)
W69-08614

USE OF DIGITAL COMPUTERS FOR MATHEMATICAL MODELLING OF HYDROLOGICAL PROCESSES,
Gruzinskii Politekhnicheskii Institut, Tiflis (USSR).
G. G. Svanidze.
Symp on Use of Analog and Digital Compute Hydrol, Tucson, Ariz, Dec 1968, Int Ass Hydrol, Pub No 80, Vol 1, p 249-257, 1968. 9 fig, 1 tab, 14 ref.

Descriptors: *River forecasting, *Stoch processes, *Mathematical models, *Statis models, *Digital computers, Synthetic hydrol Streamflow forecasting, Monte Carlo met Time series analysis, Runoff forecasting, Ma processes.
Identifiers: USSR.

Viewing river runoff as a nonstationary stoch process, the methods of modelling long hydro cal series with the aid of digital computers discussed. The mathematical techniques empl are the theory of random functions, the theor Markoff processes, and the Monte Carlo met Modelling with discrete and with continuous are considered. The limited range of initially av ble data for one basin is supplemented by mea joining data for a number of rivers with intro tion of a few hypotheses. Suggestions are mad to the choice of the necessary length of the seri of the number of short-length realizations for taining results within the prescribed confidenc tervals. Methods of group modeling (ve problem) of interdependent hydrological series also discussed. (Knapp-USGS)
W69-08624

08. ENGINEERING WORKS

8A. Structures

AUTHORIZATION, CONSTRUCTION / MAINTENANCE OF BRIDGES.

SC Code Ann secs 33-601, 33-608, 33-609, 614, 33-615 (1962).

Descriptors: *South Carolina, *Bridges, *Adm trative agencies, *Transportation, Rivers, Stre Boundaries (Property), Costs, Legal asp Bridge construction, Structures, Dams, Mill d Civil engineering, Interstate rivers, Equitable portionment, Interstate, State governments, L governments.

The State Highway Commission may coop with adjoining states in the construction and m tenance of bridges across streams constitu boundaries between this state and any such ad ing state. It may expend for such purposes not than one half the costs and bear a proportio part of the maintenance. The cost of construct repair and maintenance of bridges across w constituting the boundary between two cou shall be borne equally by both counties. Any t more counties desiring to build a bridge acros stream may enter into combination and fo bridge district. Whoever shall willfully injure bridge built by the authority of the commissi of two counties shall be punished as ordered b court of general sessions in the county of th fense. Whoever shall injure any other public b shall be guilty of a misdemeanor. All owners o dams and bridges, over which a public hig passes, shall keep such in good repair. (Helwig
W69-08170

WATER RESOURCES DEVELOPMENT THE U.S. ARMY CORPS OF ENGINEER ALABAMA.
Corps of Engineers, Atlanta, Ga.

Corps Eng Water Resources Develop Rep 1969. 59 p, 6 fig, 55 photo, 1 map, 1 tab, inde

Descriptors: *Water management (Appl *Alabama, *Water resources develop Navigation, River basin development, Flood trol, Multiple-purpose projects, Hydroelec power, Dams, River training.
Identifiers: U S Army Corps of Engineers proj (Ala).

Army Corps of Engineers water resources
pment projects in Alabama are listed. The
f the Corps of Engineers in planning and
ng water resources improvements is
bed briefly, and the procedure for initiating
tudies, authorization procedures, and status
jects are outlined. Projects described include
tion, flood control, multiple-purpose pro-
river surveys, erosion control, water supply,
pollution, power, recreation, and flood plain
s. (Knapp-USGS)
08600

ER RESOURCES DEVELOPMENT BY
U.S. ARMY CORPS OF ENGINEERS IN
O.
of Engineers, Portland, Oreg., North Pacific

Eng Water Resources Develop Rep, Jan
46 p, 4 fig, 32 photo, index.

ptors: *Water management (Applied),
), *Water resources development, Naviga-
River basin development, Flood control, Mul-
urpose projects, Hydroelectric power, Dams,
training.
fiers: U S Army Corps of Engineers projects
).

Army Corps of Engineers water resources
pment projects in Idaho are listed. The role
Corps of Engineers in planning and building
resources improvements is described briefly,
he procedure for initiating such studies,
rization procedures, and status of projects are
ed. Projects described include navigation,
control, multiple-purpose projects, river sur-
erosion control, water supply, water pollu-
ower, recreation, and flood plain studies. (K-
USGS)
08601

ER RESOURCES DEVELOPMENT BY
U.S. ARMY CORPS OF ENGINEERS IN
NSAS.
of Engineers, Vicksburg, Miss. Lower Mis-
i Valley Div.

Eng Water Resources Develop Rep, Jan
104 p, 3 fig, 42 photo, 1 map, index.

iptors: *Water management (Applied), *Ar-
s, *Water resources development, Naviga-
River basin development, Flood control, Mul-
urpose projects, Hydroelectric power, Dams,
training.
fiers: U S Army Corps of Engineers projects

Army Corps of Engineers water resources
pment projects in Arkansas are listed. The
f the Corps of Engineers in planning and
ng water resources improvements is
bed briefly, and the procedure for initiating
tudies, authorization procedures, and status
jects are outlined. Projects described include
ation, flood control, multiple-purpose pro-
river surveys, erosion control, water supply,
pollution, power, recreation, and flood plain
s. (Knapp-USGS)
08602

ER RESOURCES DEVELOPMENT BY
U. S. ARMY CORPS OF ENGINEERS IN
NA.
of Engineers, Cincinnati, Ohio. Ohio River

Eng Water Resources Develop Rep, Jan
72 p, 29 photo, 1 map, index.

ptors: *Water management (Applied), *In-
*Water resources development, Navigation,
basin development, Flood control, Multiple-
se projects, Hydroelectric power, Dams,
training.

Identifiers: U S Army Corps of Engineers projects (Ind).

U. S. Army Corps of Engineers water resources development projects in Indiana are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (K-napp-USGS)
W69-08603

8B. Hydraulics

UNSTEADY FLOW IN A RESERVOIR-CONDUIT SYSTEM,
Kansas Univ., Lawrence; and Whirlpool Corp., St. Joseph, Mich.
Yun-Sheng Yu, and Mack H. Gray, III.
OWRR Project No A-017-KAN. Water Resources Res, Vol 5, No 3, pp 660-672, June 1969. 13 p, 8 fig, 4 tab, 11 ref.

Descriptors: *Unsteady flow, *Closed conduit flow, Pipe flow, Reservoirs, Hydraulics, Hydraulic structures, Velocity, Flow, Pressure, Reynolds number.
Identifiers: Pipe-flow acceleration.

The one-dimensional method of solution computes successfully the instantaneous average displacement, velocity, and acceleration of fluid in a pipe connected to a reservoir, and the water depth in the reservoir when a valve at the end of the pipe is suddenly opened. Measurements of the instantaneous average fluid displacement in the pipe for different values of B/D (reservoir diameter to pipe diameter) agree very well with the computed values. For a specific inlet geometry and a given value of the ratio of pipe length to pipe diameter, the lumped inertial parameter decreases as B/D increases and reaches a minimum value as B/D becomes infinity. The neglect of the inertia of fluid in the reservoir in computing the unsteady flow characteristics is justifiable if B/D is larger than 90 and L/D much larger than 0.47. (Knapp-USGS)
W69-08202

A NONDIMENSIONAL APPROACH TO THE FLOW OF WATER IN FLUMES AND CANALS,
Mississippi State Univ., State College. Dept. of Agricultural and Biological Engineering.
B. P. Verma, and J. C. McWhorter.
Completion Report, Mississippi Water Resources Research Institute, July, 1969. 37 p, 3 tab, 4 fig, 7 ref, 1 append. OWRR Project A-024-MISS.

Descriptors: *Dimensional analysis, *Uniform flow, *Open channel, Flow equation.

This study develops a reliable relation for describing uniform turbulent flow of water in flumes and canals. The study involves: A dimensional analysis using the physical quantities which apply to the common case of uniform turbulent flow in a prismatic open channel; the conduct of a uniform flow experiment; the analysis of the data in order to establish a prediction equation that describes uniform flow; and the comparison of the prediction equation with data obtained from the literature on uniform flow in flumes and canals. The analysis of experimental flume data and data compiled from the literature produced a prediction equation, the form of which, describes the case of uniform flow without relying upon constants which are dimensionally questionable.
W69-08398

BASIC STUDY OF JET FLOW PATTERNS RELATED TO STREAM AND RESERVOIR BEHAVIOR,
Illinois Univ., Urbana.
W. Hall, C. Maxwell, and H. Paxwash.
Water Resources Center, Research Report No 10, July 1967. 63 p. OWWR Project A-010-Ill.

Descriptors: *Diffusion, *Flow characteristics, *Flow profiles, *Free surfaces, Air-water interfaces, *Jets, Boundary (Surfaces), Hydraulics, Interfaces.

The effect of a nearby free surface on jet flow is studied experimentally. Parameters varied included nozzle diameter, submergence, and discharge. The jets were discharged into still ambient fluid of the same density. The maximum velocity is found to move upward as the jet proceeds downstream eventually reaching the surface. The resultant wave action modified flow patterns in the upper region of the jet, though the velocity distribution in the lower portion resembles that for deeply submerged jets. The location of the filaments of maximum velocity was found to be a function of both absolute submergence as well as submergence relative to the nozzle diameter. Intakes placed near the nozzle had no measurable influence on jet flow patterns. (Benedict-Vanderbilt)
W69-08403

ON A MOMENTUM-MASS FLUX DIAGRAM FOR TURBULENT JETS, PLUMES AND WAKES,
Manchester Univ. (England).
B. R. Morton.
Journal of Fluid Mechanics, Part I, Vol 10, p 101-112, Feb 1961. 4 fig, 7 ref.

Descriptors: *Jets, *Buoyancy, Continuity equation, Momentum equation, Mathematical model, Hydrodynamics, Turbulent flow, Eddies, Reynolds number.
Identifiers: *Entrainment, Momentum flux, Mass flux, Wakes, Analytic solution, Density deficiency, Virtual source, Top-Hat profiles, Drag coefficient, Similarity assumptions, Buoyant plumes.

Many salient features of fully developed turbulent jets, plumes and wakes with steady mean flow can be shown clearly by the relationship between the momentum flux and the mass flux in the column of moving fluid. Using a simple model for the flows, this relationship can be theoretically predicted from the solution of a single ordinary differential equation, and the character of many related flows can be represented on a single momentum-mass flux diagram. Theoretical turbulent jets and wakes in a still fluid environment and in a steady ambient stream are represented on the same mass-momentum flux diagram along with buoyant wakes and plumes (buoyant jets). Chosen as examples are (1) a negatively buoyant jet of heavy fluid with strong deceleration, (2) a weaker negatively buoyant jet, (3) a buoyant jet with very weak negative buoyancy, (4) a positively buoyant jet, (5) a forced wake, and (6) a more weakly buoyant forced wake showing transition to jet flow at a distance. Also presented are curves for the dimensionless velocity excess in the jet relative to the ambient fluid and for the dimensionless jet radius plotted against dimensionless distance from a virtual source. The author suggests that the value of the entrainment coefficient, defined as the ratio of the inflow velocity to the velocity difference between jet and ambient flows, is approximately 0.116. (Motz-Vanderbilt)
W69-08410

DIFFUSION OF WARM WATER JETS DISCHARGED HORIZONTALLY AT THE SURFACE,
Chuo Univ., Tokyo (Japan).
T. Hayashi, and N. Shuto.
Proceedings: Twelfth Congress of the International Association for Hydraulic Research, Colorado State Univ., Fort Collins, Colorado, Vol 4, Part 1, pp 47-59, Sept 1967. 13 p, 14 fig, 4 tab, 6 ref.

Descriptors: *Jets, *Froude number, *Buoyancy, Continuity equation, Momentum equation, Energy equation, Mathematical model, Hydrodynamics, Heat, Heat transfer, Specific heat, Thermodynamic

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behavior, Latent heat, Vapor pressure, Wind velocity, Dye releases, Reynolds number, Turbulent flow, Convection, Temporal and spatial distributions.
Identifiers: *Entrainment, *Richardson number, *Horizontal surface jet, Similarity assumptions, Back radiation, Stefan-Boltzmann law, Lab data.

Experiments are performed on the diffusion of warm water jets discharged horizontally at the surface of quiescent water. The initial temperature difference between the jet and the ambient fluid varies from 0.2 to 28 deg C., the densimetric Froude number at the jet outlet varies from 16.1 to 1.4, and the Richardson number (Ri) at the jet outlet varies from 0.00 to 0.54. An approximate theory is developed with the main assumptions that: (1) The horizontal diffusion terms in the equation of motion equal the horizontal pressure gradient term; (2) The profiles of temperature in vertical sections are similar and the profiles of horizontal velocity in vertical sections are also similar; (3) The rate of entrainment at the bottom of the surface layer of warm water is proportional to some characteristic velocity at that vertical plane; (4) The turbulent-diffusion coefficients are constants. An approximate solution is presented for the case of the Ri number greater than 1, or for the case of no vertical entrainment. The experimental results are compared with the predicted results, and the effect of the Ri number on the diffusion of warm water jets is noted. When the Ri is greater than 1, surface heat exchange is important; when the Ri is less than 1, vertical entrainment is important. (Motz-Vanderbilt)
W69-08412

SELECTIVE WITHDRAWAL FROM DENSITY - STRATIFIED RESERVOIRS,
California Inst. of Tech., Pasadena.
For primary bibliographic entry see Field 05C.
W69-08419

SURFACE DISCHARGE OF HORIZONTAL WARM-WATER JET,
For primary bibliographic entry see Field 05B.
W69-08421

TURBULENT BOUYANT JETS INTO STRATIFIED OR FLOWING AMBIENT FLUIDS,
California Inst. of Tech., Pasadena.
For primary bibliographic entry see Field 05B.
W69-08423

NUMERICAL SOLUTIONS OF TURBULENT BOUYANT JET PROBLEMS,
California Inst. of Tech., Pasadena.
For primary bibliographic entry see Field 05B.
W69-08424

ONE-DIMENSIONAL EQUATIONS OF OPEN-CHANNEL FLOW,
California Univ., Davis. Dept. of Water Science and Engineering.
For primary bibliographic entry see Field 02E.
W69-08589

PROPAGATION OF FLOOD WAVES IN OPEN CHANNELS,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 02E.
W69-08590

8C. Hydraulic Machinery

DESALINATION-POWER PLANT PROVES ECONOMICALLY FEASIBLE,
Kaiser Engineers, Oakland, Calif.
For primary bibliographic entry see Field 03A.
W69-08295

LUENING V PUBLIC SERVICE COMMISSION (PERMIT TO CONSTRUCT HYDROELECTRIC DAM).

267 Wis 537, 66 NW 2d 190-192 (1954).

Descriptors: *Wisconsin, *Dams, *Canals, *Hydroelectric plants, Discharge, Hydroelectric power, Dam construction, Rivers, Navigation, Navigable waters, Public rights, Public health, Permits, Natural flow, Riverbeds, Boating, Fishing, Legal aspects, Judicial decisions, Administrative agencies, Local governments.
Identifiers: Rapids.

Plaintiffs instituted suit to review an order issued by the public service commission granting a permit to construct a dam and canal for hydroelectric purposes. The plaintiffs contended that the commission could not authorize the construction of the canal and were only empowered to authorize the construction of a dam across the river bed. The court held that the term 'dam' is not limited to the structure across the river bed but includes the canal which carries the water through the generating plant and back to the river bed. The court held that if the commission found, after a hearing, that the proposed dam would not interfere with navigation or violate other public rights, that it could grant a permit. The evidence adduced at the hearing indicated that the river was not suited for boating and fishing and thus substantiated the commission's conclusions. The court determined that the proposed canal could be used for navigation and thereby replace the river in that respect. The action of the public service commission was upheld. (Shevin-Fla)
W69-08319

LIMITATION OF HYDRO-ELECTRIC CHARTERS.
For primary bibliographic entry see Field 06E.
W69-08344

09. MANPOWER, GRANTS AND FACILITIES

9D. Grants, Contracts, and Research Act Allotments

FEDERAL ASSISTANCE AVAILABLE COMPANIES ESTABLISHING POLLUTI CONTROL PROGRAMS,
Federal Water Pollution Control Administrat
Washington, D. C.
For primary bibliographic entry see Field 05G.
W69-08555

10. SCIENTIFIC AND TECHNICAL INFORMATION

A REVIEW OF THE LITERATURE OF 1968 WASTEWATER AND WATER POLLUTI CONTROL.
Federal Water Pollution Control Administrat
Washington, D. C. Research Committee.
For primary bibliographic entry see Field 05D.
W69-08199

DATA SYSTEMS AND INFORMATI RETRIEVAL ADAPTABLE TO WAT RESOURCES,
Economic Research Service, Washington, D
Resource Data Systems Group.
Paul L. Holm.
Agricultural Law Center, College of Law,
University of Iowa, Monograph No 10, p 108-1
Sept. 1968. 14 p, 1 fig, 4 ref.

Descriptors: *Information retrieval, *Data sto and retrieval, *Data collections.
Identifiers: *Water Resources Regional Agri tural Analysis and Projections System.
An information retrieval system is used for loca and selecting, on demand, certain documents other graphic records containing information r vant to a given requirement form a file of s materials. There are three classifications of th systems: (1) data base, (2) reference, and (3) processing systems. Describes briefly cer systems in operation, or under development, cluding those of the Office of Water Data C dination and the Water Resources Scientific In mation Center. A data system is designed to loc select, and process data elements according standard set of decision rules. Data is unproces or raw information. There are two classification these systems: (1) data banks and (2) analyt data systems. The author identifies some urg tasks to be deliberated by an ad hoc task group approaches to research on water use data. (Gr man-Rutgers)
W69-08389

COMPUTER DOCUMENTATION A RETRIEVAL OF HYDROLOGIC INFOR TION FOR SMALL GROUPS OR INDIVIDUA
Forest Service (USDA), Berkeley, Calif. Pa
Southwest Forest and Range Experiment Statio
For primary bibliographic entry see Field 07C
W69-08511

HYDROLOGIC DATA SYSTEMS--DEVEL ING CONCEPTS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07A.
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SELECTED WATER RESOURCES ABSTRACTS

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
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VOLUME 2, NUMBER 21
NOVEMBER 1, 1969

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se of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.

- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the FWPCA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

In cooperation with the Federal Water Pollution Control Administration, the following "centers of competence" have been established:

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
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Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

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06 WATER RESOURCES PLANNING
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A. General

ING RUNOFF EVENTS TO CALIBRATE MALL FORESTED CATCHMENTS,
rest Service (USDA), Oxford, Miss. Southern rest Experiment Station.
r primary bibliographic entry see Field 07B.
69-08641

DROLOGY OF THE ALAKAI SWAMP, AUAI, HAWAII,
waii Agricultural Experiment Station, Honolulu.
ssel D. van't Woudt, and Robert E. Nelson.
waii Agricultural Experiment Station Bulletin 2, 30 p, January 1963. 13 fig, 5 tab, 19 ref.

scriptors: *Hydrologic budget, *Swamps, *Wet mate, Hawaii, Peat, Moisture content, Stream-w, Photogrammetry, Terrain analysis.
ntifiers: Alakai Swamp, Kauai.

e Alakai Swamp, about 4,000 feet in elevation, is ntinuously moisture-saturated, the result of out 250 inches of rainfall well distributed roughout the year. It acts mainly as a collecting d overflow basin with limited surface-storage pacity. (Merriam-Forest Serv)
69-08649

ULTIVARIATE METHODS USEFUL IN DROLOGY,
rest Service (USDA), Berkeley, Calif. Pacific uthwest Forest and Range Experiment Station.
r primary bibliographic entry see Field 07B.
69-08661

EOMORPHOLOGY AND SURFACE DROLOGY OF DESERT ENVIRONMENTS,
izona Univ., Tucson.
wrence K. Lustig.
W. G. McGinnies, B. J. Goldman, and Patricia ylore, Eds., Deserts of the World, an Appraisal Research into their Physical and Biological En-onments, IV University of Arizona Press, Tuc-n, 1967. 189 p, refs.

scriptors: *Geomorphology, *Surface drainage, leserts, Drainage patterns (Geologic), Topog-phy, Arid climates, Dunes, Semiarid climates, olian soils, Surface waters, Hydrology, Arid ids, Channel morphology.
ntifiers: Kalahari Desert, Namib Desert, Sahara sert, Somali-chalbi Desert, Arabian Desert, nian Desert, Thar Desert, Australian Deserts, nte-Patagonia Desert, Atacama-Peruvian sert, North American Deserts.

survey on the state of knowledge of morphology and surface hydrology of the rld's arid regions (excluding O.S.S.R. and Chin-Backgrounds of modern geomorphic concepts discussed. The detailed review of information luates each of the world's deserts separately, in-ating authorities and depositories. Political sub-isions (nations; USSR, states) are employed. sert definition is considered in terms of basic cli-tic data, mean annual values, and expansion and ttraction of deserts. Equilibrium of desert land-ms (ie. plains, topographic lows, topographic hs, alluvial fans and pediments) is considered as central problem of arid lands geomorphology. basic problems in the study of desert drainage l mapping are treated. Recommendations in-de establishment of basic data stations on nsect lines perpendicular to presumed bounda-s and extending from semiarid to extremely arid, atment of precipitation data in terms of some ameter such as kurtosis (which relates frequen-distribution), use of quantitative descriptive hniques of landforms, determination of current cesses and rates, development of a quantitative le of rock weathering, and a search for some rsical characteristics of stream channels that will serve as accurate guides to the probable discharge and frequency of discharge of desert drainage. Includes comprehensive bibliography of approximately 2,500 refs. (Sherbrooke-Ariz)
W69-08689

HYDROLOGY OF THE USSR ARID REGIONS (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
K. P. Voskresenskiy.
Trudy Gos Gidrol Inst, No 163, p 19-29, 1968. 11 p, 2 tab.

Descriptors: *Hydrology, *Arid lands, Humidity, Air circulation, Water resources, Water supply, Water users, Discharge (Water), Precipitational (Atmospheric), Climates, Water loss, Filtration, Desalination, Hydraulic engineering, Soils, Evaporation.
Identifiers: *USSR, Arid regions.

The author describes the over-all picture of USSR river discharges, with special attention given to the river discharges of the Aral-Caspian, CisAsov, and Barabinsk-Achinsk-Yeniseysk regions considered to be the dryest ones in the Soviet Union. The Pacific and Arctic Ocean basins are characterized by a runoff of 10.5 lit/sec per sq km, whereas the dry basins contribute only from 0.1 to 2.0 lit/sec per sq km. The author points out that these arid regions, in spite of their lack of water resources, are of importance in the economy of the USSR. Several steps are suggested to increase the supply and use of fresh waters in the arid regions. (Gabriel-USGS)
W69-08735

HARMONIC ANALYSIS OF THE MOUNTAIN RIVER HYDROGRAPH (RUSSIAN),
Tadzhikskii Selsko Khoziaistvennyi Institut, Dushanbe (USSR).
For primary bibliographic entry see Field 02E.
W69-08773

ACTIVATION ANALYSIS: A NEW TECHNIQUE FOR SOIL MOVEMENT STUDIES,
Iowa State Univ., Ames.
For primary bibliographic entry see Field 07B.
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DIGITAL COMPUTER SIMULATION IN HYDROLOGY,
Geological Survey, Menlo Park, Calif. Water Resources Div.
For primary bibliographic entry see Field 07C.
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GROUND WATERS AND SURFACE WATERS OF THE BURIAT-MONGOLIAN A.S.S.R. AS A SOURCE OF AGRICULTURAL WATER SUPPLY (RUSSIAN),
For primary bibliographic entry see Field 02F.
W69-08912

A COASTAL POND STUDIED BY OCEANOGRAPHIC METHODS,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 02H.
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SEISMIC INVESTIGATION OF ICE PROPERTIES AND BEDROCK TOPOGRAPHY AT THE CONFLUENCE OF TWO GLACIERS, KASKAWULSH GLACIER, YUKON TERRITORY, CANADA,
Ohio State Univ. Research Foundation, Columbus. Inst. of Polar Studies.
For primary bibliographic entry see Field 02C.
W69-08924

THE EFFECT OF MINGECHAUR RESERVOIR ON THE THERMAL REGIME OF THE LOWER REACHES OF KURA RIVER (RUSSIAN),
Akademiya Nauk SSSR.
For primary bibliographic entry see Field 02E.
W69-08925

HEAT CONDUCTIVITY OF WATER-BEARING SATURATED ROCKS AS A FUNCTION OF PRESSURE, TEMPERATURE, AND ROCK COMPOSITION (RUSSIAN),
Akademiya Nauk SSSR.
For primary bibliographic entry see Field 02F.
W69-08926

THE EFFECTS OF DENSITY OF RECORDING RAIN GAUGE NETWORKS ON THE DESCRIPTION OF PRECIPITATION PATTERNS,
California Univ., Davis. Dept. of Water Science and Engineering.
J. Amorocho, A. Brandstetter, and Don Morgan.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 189-202, 1968. 14 p, 6 fig, 6 tab, 2 ref.

Descriptors: *Networks, *Rain gauges, *Distribution patterns, *Rainfall-runoff relationships, *Depth-area-duration analysis, Model studies, Mathematical models, Statistical methods, Hydrologic data, Hyetographs, Hydrographs, Radar, Rainfall disposition.
Identifiers: Rain gauge networks, Hydrologic models.

Methods based on mathematical filtering processes applied to data from dense recording precipitation gage networks have led to the development of criteria for the determination of the effect of network densities on the definition of significant storm patterns. The application of 1 of these procedures to the analysis of storms in the Central Valley of California is reported. The experiments involve the use of over 20 battery-driven, digital recording rain gauges distributed in a special array covering an area of approximately 10 sq mi. The evolution of the storm precipitation patterns over the area is investigated by means of the data from the network in conjunction with radar echo observations. The spacings required for adequate areal pattern definition were studied, and a procedure for the correction of systematic local effects on each rain gauge was found to be sufficient to make the individual gauge data hydrologically equivalent. (Knapp-USGS)
W69-08931

RAINFALL INPUT FOR HYDROLOGIC MODELS,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
David M. Hershfield.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 177-188, 1968. 12 p, 12 fig, 1 tab, 4 ref.

Descriptors: *Rainfall-runoff relationships, *Duration curves, *Depth-area-duration analysis, Hydrologic data, *Networks, Rain gages, Model studies, Hyetographs, Hydrographs, Hydrograph analysis, Distribution patterns, Storms, Runoff, Correlation analysis.
Identifiers: Rainfall models, Hydrologic models.

A study of more than 300 rainstorms, 15 major events in each of 23 densely gaged watersheds, shows that direction of rain gage distribution is often more important than gage density in defining the characteristic dimensions of the rainfall distribution. Rainfall volume appears to be estimated adequately with only a small number of properly located gages as compared with that required for good definition of the isohyetal pattern. The depth-area curves for individual storms are generally similar in shape and direction within a watershed.

Examples are presented of time distribution and rainfall progression over the watershed. (Knapp-USGS)
W69-08932

MONSOON OVER THE INDUS VALLEY DURING THE HARAPPAN PERIOD,
Council of Scientific and Industrial Research, New Delhi (India).
For primary bibliographic entry see Field 02F.
W69-08950

TERRESTRIAL, ATMOSPHERIC AND SOLAR RADIATION FLUXES ON A HIGH DESERT MOUNTAIN IN MID-JULY: WHITE MOUNTAIN PEAK, CALIFORNIA,
California Univ., Los Angeles. Dept. of Geography.
Werner H. Terjung, Ronald N. Kickert, Gerald L. Potter, and Stanley W. Swarts.
Solar Energy, Vol 12, No 3-F, p 363-375, 1969. 13 p, 8 fig, 2 tab, 17 ref.

Descriptors: *Solar radiation, *Climatology, *California, Hydrologic cycle, Weather, Meteorology, Energy budget.
Identifiers: White Mountain Peak (Calif).

Solar radiation was measured on White Mountain Peak, California, in July at an altitude of 14,000 feet. The summed net radiation was about 575 ly and heat flux into ground was about 14 ly. Such high solar radiation is more than theory predicts for the location, and possibly the highest recorded on the Earth's surface. (Knapp-USGS)
W69-08951

2B. Precipitation

MEASUREMENT AND ESTIMATION OF PRECIPITATION ON EXPERIMENTAL WATERSHEDS,
Forest Service (USDA), Berkeley Calif. Pacific Southwest Forest and Range Experiment Station.
Edward S. Corbett.
International Symposium on Forest Hydrology, Proceedings, Pennsylvania State University, p 107-129, Aug 29-Sept 10, 1965.

Descriptors: *Precipitation (Atmospheric), *Precipitation gages, *Measurement, Demonstration watersheds, Rain, Sampling, Gaging stations, Isohyets, Variability, Climatic data, Network design, Theis equation.
Identifiers: Point sampling, *Experimental watersheds.

The literature pertinent to the measurement of precipitation (primarily rainfall) on watersheds is reviewed. Topics discussed include types of rain gages, accuracy of point rainfall measurements, selection of rain gage sites, precipitation variability and its effects on rain gage network designs, and extrapolation of point precipitation values to areal estimates. (Author)
W69-08653

PROBLEM OF THE STATISTICAL STRUCTURE OF THE FIELD OF WINTER PRECIPITATION,
Main Geophysical Observatory, Leningrad (USSR).
A. I. Polishchuk.
Soviet Hydrol: Selec Pap, Issue No 2, p 147-149, 1968. 3 p, 2 fig, 1 tab, 8 ref. Trans Trudy Gos Geophys Observ, No 215, p 153-156, 1968.

Descriptors: *Precipitation (Atmospheric), *Correlation analysis, *Precipitation gages, Networks, Statistical methods, Snowfall, Rainfall, Rainfall disposition, Winter.
Identifiers: *USSR, Precipitation structure (Statistical).

The statistical structure of winter precipitation at 15 USSR precipitation stations was analyzed. Methods of correction of monthly precipitation sums were evaluated. The space correlation function was found by averaging the correlation coefficients for pairs of stations and relating the average correlation coefficients to station separation distance. Correlation coefficients are tabulated, and correlation functions are shown by graphs. (Knapp-USGS)
W69-08726

MICROSPHERULES IN SNOW AND ICE-FOG CRYSTALS,
Army Terrestrial Sciences Center, Hanover, N.H.
Motoi Kumai.
Cold Reg Res and Eng Lab Res Rep No 245, Mar 1969. 10 p, 4 fig, 2 tab, 29 ref.

Descriptors: *Precipitation (Atmospheric), *Nucleation, *Ice, *Snow, *Fog, Arctic, Cold regions, Alaska, Freezing, Clays, Air pollution, Smoke.
Identifiers: Ice crystal nucleation, Ice fog, Microspherules.

Spherules found in snow crystals, ice-fog crystals, fallout particles, and fly ash were studied with an electron microscope using the electron diffraction method. The central part of the residues of 1004 specimens of natural snow crystals from Greenland, the United States, and Japan were examined; 14 spherules 0.1 to 1.5 microns in radius were found among them. The residues of 658 artificial ice-fog crystals formed from water vapor in flue gases of coal-burning electric power plants at Fairbanks, Alaska, were also examined; 9 spherules were found. Spherules similar to those found in ice-fog residues were found in furnace-produced fly ash fallout at Fairbanks, Alaska. The electron microscope study indicated that less than 0.7% of the 1004 snow crystals are formed mainly on clay mineral particles by heterogeneous nucleation. (Knapp-USGS)
W69-08907

OBJECTIVE ASSESSMENT OF ADEQUATE NUMBERS OF RAINGAUGES FOR ESTIMATING AREAL RAINFALL DEPTHS,
British Meteorological Office, Bracknell (England).
P. M. Stephenson.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 252-264, 1968. 13 p, 8 fig, 7 tab, 3 ref.

Descriptors: *Network design, *Rain gages, *Rainfall disposition, *Distribution patterns, *Statistical methods, Hydrologic data, Regression analysis, Correlation analysis, Probability, Isohyets, Estimating.
Identifiers: *United Kingdom, Rain gage distribution, Rain gage networks.

The assessment of the minimum number of raingages required to measure the depth of rainfall over an area within given limits of accuracy is discussed. Standard computations are not necessarily universally applicable and need to be related to the type of precipitation and the nature and size of the particular area under consideration. An approach is suggested to a solution of the problem for monthly rainfall using a largely objective statistical technique for different classes of precipitation over areas of England and Wales varying in size from a few tens of square kilometers to the whole country. The results are presented in graphical and tabular form, relating the minimum number of gages required to size of area. For small areas the results are in close accord with those previously determined empirically and used in the British Meteorological Office for planning networks. For larger areas considerable fewer gages than customarily recommended appear to be adequate. An appendix gives the results of other approaches to the problem using more limited data but also attempting a solution for daily rainfall. (Knapp-USGS)
W69-08928

ON THE POSSIBILITY OF QUANTITATIV EXTENDING PRECIPITATION RECORD MEANS OF DENDROCLIMATOLOG ANALYSIS,
National Center for Atmospheric Res Boulder, Colo.; and Arizona Univ., Tucson. L Tree-Ring Research.
P. R. Julian, and H. C. Fritts.
Symp on Geochem, Precipitation, Evapor Soil-Moisture, Hydrom, Proc Gen Assemb Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pu 78, p 243-251, 1968. 9 p, 4 fig, 1 tab, 8 ref.

Descriptors: *Paleoclimatology, *Climat *Dendrochronology, Dating, Ecology, Fo Plant growth, Precipitation (Atmosph Statistical methods, Regression analysis, Co tion analysis.
Identifiers: *Dendroclimatology.

The plant-physiological basis for expecting a tree-ring growth in appropriate environments related to climate is briefly reviewed. Emph placed upon statistical techniques designed late tree-ring growth indices to observed cli parameters. Four major problem areas for st cal analyses are specified and new techn described. These are (1) the objective class tion of the sampled tree sites as to sensitivit other desirable characteristics for dendrocli purposes, (2) the removal of growth trend sumed unrelated to climated variation, (3 selection of a linear multiple regression specifying that combination of climatic ele best related to tree-ring index series, and (4 amination of the spatial- and temporal-scale tions in the regression relation. The optimum specified by the characteristics of the sampled ring series are best related to a weighted com tion of precipitation preceding the growing se Time-scale fluctuations with periods shorter 10 yr are somewhat better related than l period fluctuations. Spatial variability is appa complicated, but statistically significant regre relations can be found for optimum sites up km from the precipitation recording station derived relationships are used to attempt th trapolation of relevant precipitation sta backward in time for semi-arid regions o Western United States. (Knapp-USGS)
W69-08929

A MEASURE OF THE SNOW PRECIPITA (FRENCH),
Alpine Glaciology Lab., Grenoble (France).
Andre Poggi.
Symp on Geochem, Precipitation, Evapor Soil-Moisture, Hydrom, Proc Gen Assemb Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pu 78, p 237-242, 1968. 6 p, 2 fig, 9 tab.

Descriptors: *Precipitation gages, *Sno *Rainfall, *Instrumentation, Water equiv Sampling, Lysimeters, Snowpacks.
Identifiers: *France.

The performance of snow gages used in Fra reviewed. Snow-catch by gages varies approxi ly inversely as the area of the receiving surfa the gage, whereas rain-catch varies with the The use of Alter's shield does not improve gaging results in clearings, and actually c poorer rain-gaging results. The difference be gaged water equivalent and meltwater measur a lysimeter varied between 1.0 and 2 6% In 100 m long and 50 m wide, snow sample mea ments and storage gage measurements corre well, with differences of 1.5 and 4.5% compa snowgage measurements. (Knapp-USGS)
W69-08930

THE EFFECTS OF DENSITY OF RECOR RAIN GAUGE NETWORKS ON THE DES TION OF PRECIPITATION PATTERNS,
California Univ., Davis. Dept. of Water Sc and Engineering.
For primary bibliographic entry see Field 02A
W69-08931

NFALL INPUT FOR HYDROLOGIC DELS,
cultural Research Service, Beltsville, Md. rograph Lab.
primary bibliographic entry see Field 02A.
-08932

E ATTENUATION AND BACKSCATTERING INFRARED RADIATION BY ICE FOG AND TER FOG,
y Terrestrial Sciences Center, Hanover, N. H.
oi Kumai, and Jack D. Russell.
l Reg Res and Eng Lab Res Rep No 264, Apr 9. 7 p, 3 fig, 4 tab, 10 ref.

criptors: *Fog, *Cold regions, *Ice, *Infrared ation, *Alaska, Light, Absorption, Optical pro- ies, Physical properties, Particle size, Tempera- , Meteorology.
tifiers: Ice fog, Light attenuation.

educing visibility, ice fog hampers the normal of traffic during severe cold weather condi- s in subarctic countries. In addition, ice fog can se extinction of the infrared beam in an infrared lance system. Because of this, the emphasis of REL's ice fog research is being placed on the ef- s of ice fog on infrared transmission. This re- presents results of a study of attenuation and kscattering of infrared radiation by fog in ska. (Knapp-USGS)
9-08943

G MODIFICATION STUDIES ON THE EENLAND ICE CAP,
ıy Terrestrial Sciences Center, Hanover, N.H.
oi Kumai.
l Reg Res and Eng Lab Res Rep No 258, Mar 9. 9 p, 9 fig, 1 tab, 8 ref.

criptors: *Fog, *Condensation, *Cloud seed- *Chemistry of precipitation, *Cold regions, tic, Meteorology, Precipitation (Atmospheric), ather modification, Nucleation, Freezing.
tifiers: *Greenland, Fog modification, Ice leation.

ing the summer of 1965, the CRREL cloud sics group carried out a study of fog modifica- by propane and dry ice seeding on the Green- Ice Cap, an area with one of the lowest con- rations of atmospheric pollution on earth. The lei of supercooled fog droplets before seeding e observed using electron microscopy and elec- diffraction methods. The nuclei of ice crystals ıed by dry ice and propane seeding were also rved using the same technique. The nuclei of supercooled fog droplets and the ice crystals ıed by seeding were found to be hygroscopic ialt particles that were easily distinguished from clay mineral nuclei of natural snow crystals. sublimation temperature of carbon dioxide is - C. The boiling point of liquid propane is - C at 1 atm pressure. It is concluded that the ice eation of supercooled fog by dry ice and liquid pane seeding is due to thermal effects. (Knapp- S)
-08960

MATION AND REDUCTION OF ICE FOG,
y Terrestrial Sciences Center, Hanover, N.H.
oi Kumai.
l Reg Res and Eng Lab Res Rep No 235, Mar 1. 21 p, 9 fig, 8 tab, 3 ref, 1 append.

criptors: *Fog, *Ice, *Alaska, *Freezing, rosols, Air pollution, Clouds, Condensation, eorology, Cold regions, Water vapor.
tifiers: *Ice fog, Fairbanks (Alaska).

ng January and February of 1962-64, Fair- s, Alaska, and vicinity was the site of a series udies dealing with ice fog and ice crystals. ılts of an investigation of the amount and ex- of air pollution and ice fog in the area are ented with special emphasis on reducing ice by decreasing the water vapor being emitted into the atmosphere. The major sources of water vapor at the 2 military installations in the region, Fort Wainwright and Eielson AFB, are the heating and powerplants and their associated cooling ponds. In the populated areas around Fairbanks, a high aerosol concentration of about 100,000 particles/cu cm exists, whereas in the uninhabited areas the concentration is extremely low (about 300 particles). Much of the high concentration is due to the burning of coal for heat and power. Because the coal is of low grade it also emits about 350,000 kg of water vapor into the atmosphere on a day when the temperature is -40C. This water vapor condenses on the aerosols and produces ice fog. Anthracite or semi-bituminous coal would reduce the water vapor output to only 1/5 of the amount produced by the low grade coal. Water vapor from cooling ponds can be reduced by freezing the surfaces of the ponds. (Knapp-USGS)
W69-08961

INFLUENCE OF TOPOGRAPHY ON RAINFALL IN WEST VIRGINIA,
West Virginia Univ., Morgantown, W. Va. Water Research Inst.
C. R. Grafton, and W. H. Dickerson.
Water Research Institute Bulletin 1, 1969. 45 p. OWRR Project A-006-WVA.

Descriptors: *Rainfall, *Rainfall disposition, *Distribution patterns, *Topography, *Statistical models, Elevation, Climatic zones, Regression analysis, Correlation analysis, West Virginia.
Identifiers: *Rainfall patterns, *Topographic influences, Computed estimation values.

The influence of topography and geographical position on mean annual precipitation was investigated by correlation and regression analysis. Of the several influences studied, elevation above sea level (actually elevation squared), latitude, and climatic division elevation deviation (a measure of the difference in elevation of the station and the mean elevation for its climatic division) proved to be the most important for the Eastern Zone. For the Western Zone, elevation, rise (a measure of the difference in elevation between the location and nearby higher land forms), and climatic division (indexed by the mean rainfall for the division in which the station was located) were the most significant of the independent variables tried. The zone dichotomy was based on a division of the state into lee and windward areas with the line of demarcation running generally northeast--southwest along the highest elevations of the mountains. Elevation accounted for about 50 percent of the variance in annual precipitation and the coefficient of multiple determination was increased to 0.66 and 0.60 (Eastern and Western Zone, respectively) by inclusion of the additional parameters. (Dickerson-W Va)
W69-09027

2C. Snow, Ice, and Frost

DENSITY VARIATION IN A SNOWPACK OF NORTHERN NEW MEXICO,
Forest Service (USDA), Albuquerque, N. Mex. Rocky Mountain Forest and Range Experiment Station.
Howard L. Gary.
Western Snow Conf Proc, 35th Annual Meeting, Boise, Ida, April 18-20, 1967. p 6-10, illus.

Descriptors: *Density stratification, *Water equivalent, *Snowpacks, *Snow surveys, Snow cover, Snowmelt, Snow management, Mountain forests, Watershed management, New Mexico.

Discusses sample variability of horizontal density measurements in snow profiles. The descending order of average sample variation in density was new snow, depth hoar, dry snow, and wet snow. (Author)
W69-08644

SNOW ACCUMULATION AND DISAPPEARANCE BY ASPECT AND VEGETATION TYPE IN THE SANTA FE BASIN, NEW MEXICO,
Forest Service (USDA), Albuquerque, N. Mex. Rocky Mountain Forest and Range Experiment Station.
Howard L. Gary, and George B. Coltharp.
US Forest Serv Res Note RM-93, 1967. 11 p, illus.

Descriptors: *Snowpacks, *Snow management, *Snow cover, *Water equivalent, *Snowmelt, *Watershed managment, Snow surveys, Water yield, Snowfall, Mountain forests, Coniferous forests, Water yield improvement, New Mexico.
Identifiers: North-south aspects.

Plots on north and south aspects under Douglas-fir, aspen, spruce-fir, and grass cover had maximum snow water equivalents ranging from 7.6 inches on the south-aspect Douglas-fir to 14.5 inches on the south-aspect grass plot. Greatest snow accumulations were observed in the high-elevation spruce-fir and grass types. In this elevation zone there was little difference in accumulation and melt between north and south aspects. Snow melting continued 4 to 5 weeks longer under spruce-fir than under other cover types. Watershed management recommendations are given. (Author)
W69-08645

CLASSIFICATION OUTLINE FOR SNOW ON THE GROUND,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
R. A. Sommerfeld.
Forest Service Research Paper RM-48, p 1-24, 1969. 14 fig, 4 ref.

Descriptors: *Snow cover, *Metamorphism, *Classification, Snow, Firn, Glaciers, Crystal growth, Ice.

A classification of snow on the ground is presented in outline form, with explanations and illustrations of the categories. The classification is based on the physical processes which result in various forms of snow particles. Thus it should be an aid in understanding the physical changes occurring as a snowpack metamorphosis. A list of words commonly used in discussions of snow metamorphism is presented since these words have often been misused. (Author)
W69-08666

CLATHRATE HYDRATES OF AIR IN ANTARCTIC ICE,
California Univ., San Diego, La Jolla. Dept. of Chemistry.
For primary bibliographic entry see Field 02K.
W69-08695

ESTIMATE OF THE RELIABILITY OF THE CHARACTERISTICS OF THE SHORTAGE IN SOLID PRECIPITATION DUE TO WIND,
Main Geophysical Observatory, Leningrad (USSR).
For primary bibliographic entry see Field 07B.
W69-08725

THICKNESS CHARACTERISTICS OF ICE ON THE PRIPYAT' RIVER,
Ministry of Melioration and Water Resources Management (USSR).
N. V. Zhitskaya.
Soviet Hydrol: Selec Pap, Issue No 2, p 161-168, 1968. 8 p, 5 fig, 3 tab, 7 ref.

Descriptors: *Ice, *Freezing, *Rivers, Heat budget, Statistical methods, Forecasting, Water supply, Streamflow forecasting, Flood forecasting.
Identifiers: *USSR, Pripyat' River, River ice formation.

The growth of the ice cover on the Pripyat' River, USSR was measured and methods of forecasting ice-cover growth by standard statistical methods were developed. Empirical formulas were obtained to relate ice growth to meteorological and hydrological factors. Graphs are presented relating ice growth to snow depth, temperature, length of cold periods, and thickness of ice already formed. (Knapp-USGS)
W69-08733

STABILITY OF DAMS IN PERMAFROST AREAS,
Alaska Univ., College.
For primary bibliographic entry see Field 08D.
W69-08862

MICROSPHERULES IN SNOW AND ICE-FOG CRYSTALS,
Army Terrestrial Sciences Center, Hanover, N.H.
For primary bibliographic entry see Field 02B.
W69-08907

SEISMIC INVESTIGATION OF ICE PROPERTIES AND BEDROCK TOPOGRAPHY AT THE CONFLUENCE OF TWO GLACIERS, KASKAWULSH GLACIER, YUKON TERRITORY, CANADA,
Ohio State Univ. Research Foundation, Columbus. Inst. of Polar Studies.
Gilbert Dewart.
Ohio State Univ Inst of Polar Studies Rep No 27, Sept 1968. 207 p, 40 fig, 8 tab, 149 ref.

Descriptors: *Ice, *Glaciers, *Bedrock, *Topography, Heat balance, Energy, Seismic studies, Anisotropy, Valleys, Winds, Air temperature, Crystallography, Geology, Climates, Physical properties, Fissures (Geology), Structural analysis.
Identifiers: *Canada, Kaskawulsh Glacier, Yukon Territory.

The purpose of this study was (1) to investigate seismic velocity inhomogeneity and anisotropy in strongly deformed glacier ice; and (2) to determine the form and dimensions of that part of a sub-glacial valley where 2 large temperate glaciers merge. Noise detecting seismographs, boreholes, geological studies, and refraction and reflection seismic surveys were utilized in the area. The seismic noise in the glacier area is due to wind action, and the mean P-wave and S-wave velocities in the glacier at depths 10-100 m are 3.63 km and 1.74 km/sec, respectively. From 10 m depth to the surface the velocities of P- and S-waves decrease markedly to 3.0 km/sec and 1.5 km/sec, respectively. It is concluded that velocity anisotropy is due to ice crystal orientation, foliation structure of alternating ice layers, and crystallographic features. The greatest depth of ice in the Central Arm is about 1000 m, and both arms of the glacier are roughly parabolic in cross-section. (Gabriel-USGS)
W69-08924

A MEASURE OF THE SNOW PRECIPITATION (FRENCH),
Alpine Glaciology Lab., Grenoble (France).
For primary bibliographic entry see Field 02B.
W69-08930

RECESSION OF PERMAFROST IN A CULTIVATED SOIL OF INTERIOR ALASKA,
Alaska Agricultural Experiment Station, Palmer; and Soil Conservation Service, Palmer, Alaska.
For primary bibliographic entry see Field 02G.
W69-08936

FORMATION AND REDUCTION OF ICE FOG,
Army Terrestrial Sciences Center, Hanover, N.H.
For primary bibliographic entry see Field 02B.
W69-08961

2D. Evaporation and Transpiration

SOIL MOISTURE DEPLETION PATTERNS AROUND SCATTERED TREES,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 02G.
W69-08665

INCREASING WATER YIELD FROM FOREST, CHAPARRAL, AND DESERT SHRUB IN ARIZONA,
For primary bibliographic entry see Field 03B.
W69-08685

STRUCTURE OF THE WATER BALANCE OF BODIES OF WATER,
Ministry of Melioration and Water Resources Management (USSR).
N. M. Kurganova.
Soviet Hydrol: Selec Pap, Issue No 2, p 150-153, 1968. 4 p, 1 fig, 2 tab, 3 ref.

Descriptors: *Water balance, *Hydrologic budget, *Reservoir design, *Statistical methods, Correlation analysis, Inflow, Evaporation, Streamflow, Precipitation (Atmospheric).
Identifiers: *USSR, Reservoir water balance.

Lake and reservoir water balances in the USSR are compared statistically. Surface area, catchment area, precipitation, inflow, evaporation, and outflow data are tabulated. The ratio of catchment area to water surface area is related to the effects of the elements of the water balance; as the ratio decreases, precipitation plays an increasing role and the evaporation role increases. The relations are shown by graphs and may be used in reservoir planning and design. (Knapp-USGS)
W69-08729

ABOUT THE PROBLEM OF THE DETERMINATION OF SHORT-PERIOD EVAPORATION AMOUNTS,
Meteorologischer Dienst der Deutschen Demokratischen Republic, Berlin. Forschungsinstitut fuer Hydrometeorologie.
D. Richter.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 293-299, 1968. 7 p, 4 fig, 1 tab, 6 ref.

Descriptors: *Evaporation, *Reservoir evaporation, Mathematical models, Evaporation pans, Water balance, Temperature, Hydrologic budget, Heat budget, Winds, Energy budget.
Identifiers: *Germany, Lake Stechlin (Germany).

Numerous recent investigations on the evaporation of free water surfaces yield remarkable improvement of the knowledge about this water budget parameter. At present monthly values may easily be assessed by several methods, accurate enough for operational requirements. However, a major problem is the determination of short-period evaporation. The basic theoretical concepts were obtained by recent studies of the exchange processes in the near-ground layer of air. The measuring technique is improved by the development of eddy flux evaporation measurements. In the present study the attempt was made to use theoretical formulas and measuring techniques to obtain diurnal and hourly values of the evaporation from a free water surface without employing empirical relations and constants. To test the theory, an investigation was made on Lake Stechlin, Germany with a wind-velocity gradient measuring unit, psychrometers, and water temperature thermometers. Calculated evaporation averages less than measured evaporation, and agreed well with data showing that evaporation-pan measurements are usually too high. (Knapp-USGS)
W69-08927

EVAPOTRANSPIRATION FROM TWO P LAND WATERSHEDS,
Forest Service (USDA), Grand Rapids, North Central Forest Experimental Station.
Roger R. Bay.
Symp on Geochem, Precipitation, Evapor Soil-Moisture, Hydrom, Proc Gen Assemb Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pu 78, p 300-307, 1968. 8 p, 1 fig, 4 tab, 14 ref.

Descriptors: *Evapotranspiration, *Bogs, nesota, Water balance, Energy budget, watersheds, Lakes, Humid climates, Runoff, fall-runoff relationships.
Identifiers: Thornthwaite method.

Measurements of precipitation runoff, and water table levels provided data for the calcul of evapotranspiration from 2 forested pea watersheds near Grand Rapids, Minnesota. tinuous hydrologic records were collected on perimental bog for 6 yr (1961-1966) and o other for the past 2 yr (1965-1966). Water changes in each bog were converted to in depth of storage by water yield coefficient specific peat horizons and used to adjust prec tion-runoff calculations. Evapotranspiration mates for the growing-season period May November 1 ranged from 87 to 121% of pot evapotranspiration computed by the Thornth method. Midsummer evapotranspiration (June 1 to Sept 1) were 70 to 99% of pot evapotranspiration. Mean daily evapotranspir values from both bogs during short summer d periods were consistently less than the calcu potential values. (Knapp-USGS)
W69-08933

SOIL WATER EVAPORATION: SURF RESIDUE RATE AND PLACEMENT EFFEC
Agricultural Research Service, Mandan, N. Northern Plains Branch.
J. J. Bond, and W. O. Willis.
Soil Sci Soc Amer Proc, Vol 33, No 3, p 445 May-June 1969. 4 p, 4 fig, 15 ref.

Descriptors: *Evaporation, *Evaporation co *Soil moisture, *Stubble mulching, Water co vation, Water management (Applied), Labor tests, Water yield improvement, Mulching.
Identifiers: *Evaporimeters.

Evaporation rates were measured in colum originally wetted fine sandy loam soil subject uniform daily evaporative potential and tr with various rates of surface residue. During t itial constant-rate drying stage, evapor decreased with increasing residue rates. Con tively, the period of constant rate drying wa precipably lengthened with decreasing evapor rates. After prolonged falling rate drying, cu tive evaporative losses were nearly equal irre tive of surface residue. It was hypothesized during falling-rate, drying and with limited q ties of residue, total evaporation might be less residue were placed on less than the entire so face in concentrated zones. Utilizing the ava data, calculated curves were constructed supported the hypothesis. (Knapp-USGS)
W69-08953

2E. Streamflow and Runoff

STREAM LENGTHS AND BASIN AREA TOPOLOGICALLY RANDOM CHANNEL WORKS,
California Univ., Los Angeles.
Ronald L. Shreve
J Geol, Vol 77, No 4, p 397-414, July 1969. 16 fig, 2 tab, 20 ref.

Descriptors: *Geomorphology, *Drainage de *Drainage patterns (Geologic), *Stati methods, *Probability, Streams, Drainage sys Tributaries, Networks, Statistical models, M matical models.
Identifiers: Drainage basin topology, Stream Stream length, Topology.

topological properties of random channel net-
ks are examined to clarify the relationships of
am lengths, stream orders, and basin areas. In
te topologically random channel networks with
cified stream numbers, the expected number of
s per stream and per subnetwork of given order
given by closed but complicated formulas, from
ch the expected stream lengths and Schumm
gths can be calculated. As observed in natural
works, in a topologically random population,
the expected stream lengths do not satisfy Hor-
's geometric-series law as well as the expected
am numbers, whereas the expected Schumm
gths do, (2) on Horton diagrams the curves are
ightest for the most probable networks of order
er or higher, respectively, than the most proba-
and (3) the geometric-mean stream-length and
umm-length ratios are about 2 and 4.5, respec-
ly. The corresponding results for basin areas are
ctly the same as for Schumm lengths. In the
th Amboy basin studied by Schumm, the
rage area draining directly overland into unit
gth of channel is not a constant independent of
particular position of the channel in the basin as
proposed, but is less for exterior links than for
erior links. Substantial differences in the relative
as draining into sources and in other
morphic characteristics are not reflected in
rton diagrams because the Horton variables are
rages that are mainly determined by network
ology. Of most fundamental significance, there-
e, are not the Horton variables, but the more
mentary quantities, such as link lengths and
rce areas. (Knapp-USGS)
9-08697

**EST-STAGE GAGING STATIONS IN
EGON,**
ological Survey, Portland, Oreg.
n Friday.
ol Surv Open-file Rep, Apr 1969. 90 p, 6 fig, in-
.

scriptors: *Data collections, *Stream gages,
regon, Stage-discharge relations, Streamflow,
noff, Flow measurement, Water levels.
ntifiers: *Crest-gage stations.

est-stage gage data compiled in Oregon from Oct
52 to Sept 1968 are presented. Each record con-
s of a brief description of the location and physi-
features of the gage site, and a table of peak
a collected in the period of record. Basin
iracteristics are given if they have been evalu-
d. (Knapp-USGS)
9-08704

**ATER RESOURCES DEVELOPMENT BY
E U.S. ARMY CORPS OF ENGINEERS IN
W JERSEY.**
rps of Engineers, New York. North Atlantic Div.
primary bibliographic entry see Field 08A.
9-08710

**ATER RESOURCES DEVELOPMENT BY
E U.S. ARMY CORPS OF ENGINEERS IN
ASKA, 1969.**
rps of Engineers, Portland, Oreg. North Pacific

primary bibliographic entry see Field 08A.
9-08718

**OOD PLAIN INFORMATION, NEOSHO
ER AND TAR CREEK, MIAMI,
LAHOMA.**
ps of Engineers, Tulsa, Okla.

ps Eng Flood Plain Rep, June 1969. 49 p, 8 fig,
late, 14 tab. Prepared for the city of Miami.

scriptors: *Floods, *Flood damage, *Oklahoma,
od plains, Flood control, Non-structural alter-
ives, Maximum probable flood, Historic flood.
ntifiers: Miami (Okla), Neosho River, Standard
ject flood, Intermediate regional flood.

Flooding of the Neosho River and Tar Creek, Miami, Oklahoma is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-08719

FLOOD PLAIN INFORMATION, RIO GRANDE, MONTE VISTA, COLORADO.
Corps of Engineers, Albuquerque, N. Mex.

Corps Eng Flood Plain Rep, June 1969. 40 p, 8 fig, 15 plate, 11 tab. Prepared for the city of Monte Vista.

Descriptors: *Floods, *Flood damage, *Rio Grande, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Monte Vista (Colo), Standard project flood, Intermediate regional flood.

Flooding of the Rio Grande, Monte Vista, Colorado is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-08720

FLOOD PLAIN INFORMATION, DRY CREEK, CHEYENNE, WYOMING - VOLUME 1,
Corps of Engineers, Omaha, Nebr.

Corps Eng Flood Plain Rep, Apr 1969. 23 p, 6 plate, 6 photo, 4 tab. Prepared for the city of Cheyenne.

Descriptors: *Floods, *Flood damage, *Wyoming, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Cheyenne (Wyo), Standard project flood, Intermediate regional flood.

Flooding of Dry Creek, Cheyenne, Wyoming is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-08721

METHODS OF ESTIMATING MAXIMUM DISCHARGE OF GIVEN PROBABILITY,
Ministry of Melioration and Water Resources Management (USSR).
I. Ye. Kuksin.
Soviet Hydrol: Selec Pap, Issue No 2, p 157-160, 1968. 4 p, 2 tab, 8 ref.

Descriptors: *Flood forecasting, *Streamflow forecasting, *Statistical methods, Hydrograph analysis, Maximum probable flood, Probability, Frequency analysis, Estimating.
Identifiers: USSR, Gumbel method.

Methods are given for estimating the probabilities of given discharges from streamflow data. The most commonly used methods are interpretations of data plotted on various distribution curves. The gamma-distribution or binomial curve and the 3-parameter gamma distribution are commonly used in the USSR, and the log-normal curve, binomial curve, and the Fisher-Tippet curve are used elsewhere. Flood data from 3 gaging stations were used to test the methods of interpreting distribution curves. The most efficient method of estimating discharge probability, both theoretically and practically, was using the method of maximum likelihood and the binomial curve. The method of quantiles estimates maximum discharges better than the method of moments. The best estimates are by Gumbel's methods based on a theory of the extreme terms of a sample. (Knapp-USGS)
W69-08724

STATISTICAL METHOD OF DETERMINING THE OPTIMUM NUMBER OF MEASUREMENTS OF STREAMFLOW CHARACTERISTICS,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 07A.
W69-08728

SUBSURFACE FEEDING OF RIVERS IN THE NEMAN BASIN,
Ministry of Melioration and Water Resources Management (USSR).
V. V. Drozd.
Soviet Hydrol: Selec Pap, Issue No 2, p 153-157, 1968. 5 p, 3 tab, 12 ref.

Descriptors: *Base flow, *Rivers, *Groundwater basins, Groundwater movement, Hydrograph analysis, Statistical methods, Correlation analysis, Surface-groundwater relationships, Streamflow, Data collections.
Identifiers: *USSR.

The groundwater flow into the rivers of the Neman Basin, USSR is described. The major aquifers drained by streams are alluvial gravels and glacial valley-fill deposits. Data collected for 15-20 yr were analyzed statistically and are tabulated. (Knapp-USGS)
W69-08730

THICKNESS CHARACTERISTICS OF ICE ON THE PRIPYAT' RIVER,
Ministry of Melioration and Water Resources Management (USSR).
For primary bibliographic entry see Field 02C.
W69-08733

LIMITING MAXIMUM DISCHARGES IN LIT/SEC/SQ KM OF THE EARTH'S RIVERS AND THE METHODS FOR THEIR DETERMINATION (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
D. L. Sokolovskiy.
Trudy Gos Gidrol Inst, No 163, p 3-8, 1968. 6 p, 1 tab, 9 ref.

Descriptors: *Discharge (Water), *Runoff, *Earth (Planet), *Rivers, Floods, Winter, Summer, Mathematical models, Meteorological data, Hydrologic data, Snowmelt, Statistical methods, Rain, Slopes, Heat balance.
Identifiers: Rain runoff.

Maximum rain runoff of the earth was investigated analytically and experimentally using maximal daily precipitation versus maximal rain runoff recorded in the USSR, Mediterranean Countries, North and South America, and Asia. A formula is proposed in which maximum elemental discharge is less than or equal to the product of water-supply intensity and empirical runoff, infiltration, and evapotranspiration coefficients. The maximum discharges computed by using the meteorological and hydrometrical data give similar values, in spite

of the errors involved in the recording of these data. (GabrielaUSGS)
W69-08736

REDUCTION OF A RIVER RUNOFF SERIES TO A LONG-TERM PERIOD BY USING A METHOD OF MULTILINEAR CORRELATION (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
A. V. Rozhdestvenskiy, and A. G. Lobanova.
Trudy Gos Gidrol Inst, No 163, p 9-18, 1968. 10 p, 3 fig, 2 tab, 7 ref.

Descriptors: *Rivers, *Runoff, *Mathematical models, *Correlation analysis, Analog models, Hydrologic data, Gaging stations, Least squares method, Reliability, Electronic equipment.
Identifiers: *USSR, Svir', Neva, Vuoksa, Belaya, and Chusovaya Rivers.

The runoffs of Svir', Neva, Vuoksa, Belaya and Chusovaya Rivers were analyzed by using a method of multilinear correlation. The method is based on the numerical determination of the coefficients of regression expressed by a linear equation connecting the observed runoffs with those at the analogous points. The regression coefficients can be determined by using a technique developed by V. I. Romanovskiy (1938). The computed regression coefficients were applied to the long-term river discharge data. The reduction of a river runoff series to a long-term period, especially by using an electronic computer, can be considered as a dependable method. (Gabriel-USGS)
W69-08737

MATHEMATICAL MODELS FOR THE DISPERSION OF RADIONUCLIDES IN AQUATIC SYSTEMS,
Texas Univ., Austin. Environmental Health Engineering Research Lab.
Neal E. Armstrong, and Earnest F. Gloyna.
Available from CFSTI as CONF 670503. Proc 2nd Nat Symp on Radioecology, CONF 675030, May 15-17, 1967, Ann Arbor, Mich, p 329-335, Mar 1969. 7 p, 4 fig, 23 ref.

Descriptors: *Dispersion, *Radioisotopes, *Surface waters, *Water pollution effects, *Mathematical models, Equations, Diffusion, Sorption, Hydraulic models.
Identifiers: Radioisotope dispersion.

A general equation is presented which describes radionuclide transport in terms of hydraulic dispersion and convection and by detention systems which sorb and release. A model describes sorption by various substrates using the concentration gradient between the equilibrium activity in the substrate and the actual activity. Linear equations allow an easy solution, while the non-linear form permits ready comparison of sorption mechanisms between systems. (See also Vol 2, No 18, 05C, W69-07441). (Knapp-USGS)
W69-08739

MEASUREMENTS OF BACKGROUND RADIATION IN AQUATIC HABITATS IN ALASKA,
Dartmouth Coll., Hanover, N. H. Dept of Biological Sciences; and Army Terrestrial Sciences Center, N.H.
G. E. Likens, and P. L. Johnson.
Available from CFSTI as CONF 670503. Proc 2nd Nat Symp on Radioecology Conf 670503, May 15-17, 1967, Ann Arbor, Mich, 319-328, Mar 1969. 10 p, 3 fig, 2 tab, 21 ref.

Descriptors: *Radioactivity, *Surface waters, *Alaska, *Background radiation, Lakes, Ponds, Streams, Sediments, Provenance, Radioecology, Arctic, Tundra.
Identifiers: Natural radioactivity.

Measurements of ionizing radiation, made during 1965 in 9 lakes, 3 rivers, 1 hot springs area and adjacent terrestrial substrates in Alaska, indicated that the background radiation in these habitats varied greatly. The lakes were characterized by a small amount of ionizing radiation at mid-depths and increasing quantities near the air and sediment boundaries. Moreover, the radioactivity of the sediments near shore was up to 3.2 times as high as the sediment values near the center. This pattern of background radiation has been relatively consistent in natural lakes of diverse geographic areas; hence, a model for background radiation in freshwater lakes is proposed. Variations in this model were a function of local differences in geologic substrates and input of allochthonous materials. The radioactivity from sediments in ponds of the Arctic tundra was due to naturally occurring radionuclides. (See also VOL 2, No 18, 05C, W69-07441). (Knapp-USGS)
W69-08740

WATER RESOURCES OF THE SCHUYLKILL RIVER BASIN,
Geological Survey, Harrisburg, Pa.
J. E. Biesecker, J. B. Lescinsky, and C. R. Wood.
Penn Dep Forests and Waters, Water Resources Bull No 3, May 1968. 198 p, 74 fig, 68 tab, 95 ref, 1 append.

Descriptors: *Water resources, *Water utilization, *Surface waters, *Groundwater, *Pennsylvania, Water quality, Water sources, Streamflow, Groundwater basins, Municipal water, Industrial water, Water levels, Water pollution, Acid mine water, Silting, Water pollution control, Sediment load, Data collections, Hydrologic data.
Identifiers: Schuylkill River (Penn), Philadelphia.

The water resources of the Schuylkill River Basin, Pennsylvania are evaluated by a comprehensive study of groundwater and surface water quantity, quality, and use. Special attention is given to the effects of coal mining, urbanization, and the effects of restoration and water pollution control of the Schuylkill River. In many parts of the basin, human activities are the most important hydrologic factor. Coal mining affects both groundwater and surface water quality in the headwaters and affects the quality of the entire main stem of the river. Reservoir regulation affects the flow of several tributaries. Philadelphia diverts up to 91% of the streamflow of the Schuylkill for public supply. Pumping is lowering groundwater levels in many areas. Mean annual runoff is 21.5 inches, or 48% of the annual precipitation of 44.7 inches. The population of the basin is 1.47 million, 91% served by public supply. The water problems of the basin result mainly from inadequate municipal water systems and degradation of sources by pollution. (Knapp-USGS)
W69-08744

SEDIMENT DATA FOR CANADIAN RIVERS-1966.
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 02J.
W69-08746

WATER RESOURCES DATA FOR TEXAS, 1968-PART 1. SURFACE WATER RECORDS.
Geological Survey, Austin, Tex.

Geol Surv Basic Data Duplicated Rep, 1969. 591 p, 1 fig, index.

Descriptors: *Data collections, *Surface waters, *Streamflow, *Texas, Stream gages, Lakes, Reservoirs, Stage-discharge relations, Water supply.
Identifiers: *Surface water records, Water resources data.

The surface-water records for the 1968 water year for gaging stations, partial-record stations, and miscellaneous sites in Texas are presented. The data generally comprise a description of the station and a table showing the daily discharge and monthly and yearly discharge of the stream. The description of the station gives the location, drainage area, records available, type and hist
of gages, average discharge, extremes of dischar
and general remarks. The type of gage currentl
use and the datum of the gage above mean
level, and a condensed history of the types, lo
tions, and datums of previous gages used during
period of records available are listed. Informat
on the accuracy of the records and conditi
which affect the natural flow is given under '
marks.' Daily discharges, average discharge,
tremes, yearly totals, and peak discharges are lis
in table. (Knapp-USGS)
W69-08758

WATER RESOURCES DATA FOR NOR CAROLINA, 1968-PART 1. SURFACE WAT RECORDS.
Geological Survey, Raleigh, N.C.

Geol Surv Basic Data Duplicated Rep, 1969. 24
2 fig, index.

Descriptors: *Data collections, *Surface wat
*Streamflow, *North Carolina, Stream gag
Lakes, Reservoirs, Stage-discharge relatio
Water supply.
Identifiers: *Surface water records, Wa
resources data.

The surface-water records for the 1968 water y
for gaging stations, partial-record stations, a
miscellaneous sites in North Carolina
presented. The data generally comprise a descr
tion of the station and a table showing the d
discharge and monthly and yearly discharge of
stream. The description of the station gives the
cation, drainage area, records available, type
history of gages, average discharge, extremes
discharge, and general remarks. The type of g
currently in use and the datum of the gage ab
mean sea level, and a condensed history of
types, locations, and datums of previous gages u
during the period of records available are listed.
formation on the accuracy of the records and c
ditions which affect the natural flow is given un
'Remarks.' Daily discharges, average discharge,
tremes, yearly totals, and peak discharges are lis
in a table. (Knapp-USGS)
W69-08759

HYDROLOGIC CONDITIONS DURING 1966 DADE COUNTY, FLORIDA,
Geological Survey, Tallahassee, Fla.
John E. Hull, and Claiborne F. Galliher.
Geol Surv Open-file Rep, Dec 1968. 41 p, 36 fi
tab, 7 ref.

Descriptors: *Data collections, *Hydrologic d
*Florida, Water levels, Water wells, Aquifers,
noff, Streamflow, Rainfall, Hydrographs, Wa
level fluctuations, Discharge (Water), Water yi
Canals, Drainage, Recharge.
Identifiers: *Dade County (Fla).

Hydrologic conditions of Dade County, Florid
1966 are described in an information report c
sisting of tables, maps, graphs, and explanat
text. Water levels, stream and groundw
discharge, and rainfall data were obtained from
extensive network of observation wells, stre
gaging stations, and rainfall stations. (Kn
USGS)
W69-08762

HARMONIC ANALYSIS OF THE MOUNT RIVER HYDROGRAPH (RUSSIAN),
Tadzhikskii Selsko Khozlaistvennyi Inst
Dushanbe (USSR)
V. N. Suschevskiy, and F. T. Kozlov
Dokl Akad Nauk Tadzh, SST, Vol 11, No 9, p
58, 1968. 3 p, 1 fig, 6 ref.

Descriptors: *Hydrograph analysis, *Ri
*Streamflow, *Mathematical studies, Fourier a
ysis, Runoff, Discharge (Water), Highwater le
Correlation analysis, Floods, Low water mark

tifiers: *USSR, Shakh-Dara River, Tadz-stan.

harge data for 1947, 1948, and 1958 of the kh-Dara River Tadzhikistan, were analyzed by g the Fourier series with the mean monthly and ual river discharges expressed in cu m/sec. It assumed, on the basis of V. L. Shul'ts' in-igations of the Central Asia Rivers (1956), that coefficients of the Fourier series are a function he mean annual discharges and the hydrologic of Shakh-Dara can be quite satisfactorily ex-ssed by using the first 3 terms of the series. The edure of the harmonic analysis consists of the ulation of the mean annual discharge of given uency and then of the calculation of the Fouri-eries coefficients. By substituting the calculated meters into the Fourier series, the mean thly discharges can be readily evaluated. briel-USGS)
-08773

HNIQUE FOR LONG RANGE PREDICTION STREAM FLOW,
nson Univ., S.C.
ard M. Greening, and Albert G. Law.
nson Univ Water Resources Research Institute, t No 10, May 1969. 95 p, 6 tab, 18 fig, 28 ref, 3 end. OWRR Project A-010-SC.

criptors: Runoff, *Streamflow, Surface waters, er supply, *River forecasting, Hydrologic lels, *Streamflow forecasting.

problem of predicting streamflow for an ex-led period has received very little attention. work that has been done on this problem is lar-confined to the prediction of seasonal or an-flow volumes from snow melt by use of multi-correlation techniques. The period selected for liction was one month, since this is believed to n operationally useful time unit for potential s of the forecast product. The major factors af-ing the streamflow for the next month are be-d to be three in number. These are carry-over ow from antecedent groundwater flow and sur-runoff and runoff resulting from precipitation rring during the month to be forecast. A edure was devised to reflect each of these fac-. The river basin selected for testing the cast technique was the drainage area of the nee River near Greensboro, Georgia. The nique was developed using three years of ob-ed data and then tested using two years of inde-dent data. Median discharge and an adjusted ian discharge were used as a standard to test validity of the prediction technique. (Law-nson)
-08888

ACHAY RIVER MUD FLOW OF AUGUST 1964 (RUSSIAN),
demiya Nauk SSSR.
. Akhundov.
Akad Nauk, Azergaidzh, SSR, No 6, p 97-103, 7 p, 4 fig, 7 ref.

criptors: *Mudflows, *Streamflow, *Rivers, d damage, Dams, Bridge failure, Crops, Cities, rologic properties, River basins, Watersheds ides), Altitude, Slopes, Seasonal, Discharge ter), Altitude, Air circulation, Currents ter).
tifiers: *USSR, *Talachay River.

article describes in detail the hydrological acteristics and the damage done by a mudflow ugust 19, 1964 of the Talachay River located e greater Caucasus Mountains, USSR. The flow consisted mainly of gravel and pebble rial occassionally containing some large boul-; however, the river water samples contained 0 kg/cu m of silt during the mudflow duration. mudflow lasted about 7 hr with the maximum harge of 265 cu m/sec at the Meshlesh Village of 60 and 40 cu m/sec respectively, on the banchay and Bakhmazchay streams, tributa-f the Talachay River. (Gabriel-USGS)
W69-08900

HYDROLOGICAL YEAR-BOOK OF ISRAEL 1966-67.
Ministry of Agriculture, Jerusalem (Israel). Hydrological Service.

Israel Hydrol Serv Year-book, Jerusalem, 1969. 155 p.

Descriptors: *Hydrologic data, *Streamflow, *Groundwater, *Water levels, *Water quality, Data collections, Hydrographs, Peak discharge, Low flow, Surface waters, Gaging stations, Aquifers, Springs, Lakes, Saline lakes.
Identifiers: *Israel, *Periodic observations.

Hydrological and chemical data for gaging stations of rivers, wadis, springs, and lakes for the period Oct 1966 to Sept 1967 are presented. Groundwater data are summarized in a map showing water levels and salinity contours in the aquifers in the Coastal Plain and Foothills Area in autumn 1967. The 1966-67 precipitation and runoff were slightly below the 10-yr average at all stations. (Knapp-USGS)
W69-08908

PRELIMINARY TIDAL FLOOD INFORMATION FOR THE COASTAL AREA OF CHATHAM COUNTY, GEORGIA.
Corps of Engineers, Savannah, Ga.

Corps Eng Flood Plain Rep, Dec 1968. 21 p, 6 plate, 7 tab.

Descriptors: *Floods, *Flood damage, *Georgia, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Shores, Tides, Erosion, Beach erosion, Historic flood.
Identifiers: Chatham County (Ga), Standard project flood, Intermediate regional flood.

Flooding of the coastal area of Chatham County, Georgia is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-08909

FLOOD PLAIN INFORMATION, COLUMBIA RIVER AND TRIBUTARIES, COWLITZ COUNTY, WASHINGTON.
Corps of Engineers, Portland, Oreg.

Corps Eng Flood Plain Rep, Jan 1969. 83 p, 8 fig, 46 plate, 29 tab. Prepared for Cowlitz County, Wash.

Descriptors: *Floods, *Columbia River, *Flood damage, *Washington, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Cowlitz County (Wash), Standard project flood, Intermediate regional flood.

Flooding of the Columbia River, Cowlitz County, Washington is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-08910

FLOOD PLAIN INFORMATION, LAGUNA CANYON, ORANGE COUNTY FLOOD CONTROL DISTRICT.
Corps of Engineers, Los Angeles, Calif.

Corps Eng Flood Plain Rep, Mar 1969. 31 p, 18 fig, 24 plate, 5 tab. Prepared for Orange County Flood Control District.

Descriptors: *Floods, *Flood damage, *California, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Orange County (Calif), Standard project flood, Intermediate regional flood.

Flooding of Laguna Canyon, Orange County, California is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-08911

RADIOACTIVE TRACERS IN HYDROLOGICAL RESEARCHES IN USSR,
Moscow State Univ. (USSR).
S. J. Vartazarov, N. I. Ilyin, N. J. Flexer, and A. I. Jakovlev.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 156-161, 1968. 6 p, 2 fig, 22 ref.

Descriptors: *Tracers, *Radioisotopes, Groundwater movement, Currents (Water), Streamflow, Sedimentation, Bed load, Suspended load, Tracking techniques.
Identifiers: *USSR.

The use of radioactive tracers in hydrological work in the USSR is outlined. Tracer experiments in groundwater flow, riverflow, sea currents, and sedimentary processes are briefly described. Some formulas and equations used in Soviet tracer experiments are listed and explained. (Knapp-USGS)
W69-08913

THE EFFECT OF MINGECHAUR RESERVOIR ON THE THERMAL REGIME OF THE LOWER REACHES OF KURA RIVER (RUSSIAN),
Akademiya Nauk SSSR.
R. B. Tarverdiyev.
Izv Akad Nauk, Azerbaidzh. SSR, No 1, p 49-55, 1969. 7 p, 6 fig, 3 tab, 2 ref.

Descriptors: *Reservoirs, *Thermal water, *Rivers, *River basins, *Water temperature, Seasonal, Winter, Hydroelectric plants, Autumn, Spring, Summer, Estuaries, Discharge (Water), Fish harvest, Irrigation efficiency.
Identifiers: Kura River, Transcaucasia, USSR.

The effect of the Mingechaur Reservoir on the thermal regime of the Kura River was investigated on the basis of temperature information collected at 14 stations on the river since 1930. Considerable change in water temperature has occurred since construction of the Mingechaur Reservoir. The change occurred during 2 periods: (1) autumn-winter period, characterized by a temperature increase of+6.0 deg at Mingechaur,+8.0 deg at Yevlakh,+3.5 deg at Zardob,+1.3 deg at Alibayramlov, and+1.1 deg in the estuary; and (2) spring-summer period characterized by a temperature decrease of -4.6 deg at Mingechaur, -5.8 deg at Yevlakh, -3.6 deg at Zardob, -1.4 deg at Alibayramlov, and -0.9 deg in the estuary. These changes in thermal regime of the Kura River may affect the fishing industry and irrigation possibilities. (Gabriel-USGS)
W69-08925

FLOOD PLAIN INFORMATION, WALNUT CREEK, CITY OF MACON AND BIBB COUNTY, GEORGIA.
Corps of Engineers, Savannah, Ga.

Prepared for the city of Macon and Bibb County, Georgia. Corps Eng Flood Plain Rep, Dec 1968. 42 p, 12 fig, 15 plate, 14 tab.

Descriptors: *Floods, *Flood damage, *Georgia, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Macon, Bibb County (Ga.), Standard project flood, Intermediate regional flood.

Flooding of Walnut Creek, Macon and Bibb County, Georgia is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-08934

SURFACE WATER DATA REFERENCE INDEX OF ALBERTA-1968.
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.

Inland Waters Br Water Surv of Canada Basic Data Rep, 1969. 53 p, 2 map, 1 tab, 2 index.

Descriptors: *Surface waters, *Stream gages, *Gaging stations, Data collections, Hydrologic data, Streamflow, Water levels.
Identifiers: *Canada, Alberta

Surface water stations in Alberta, Canada are listed. Station identification number, name, drainage area, gage location availability of discharge records, type of gage, operation, recorder type, and remarks are tabulated. Station locations are shown by maps. (Knapp-USGS)
W69-08941

SURFACE WATER DATA REFERENCE INDEX OF YUKON TERRITORY AND NORTHWEST TERRITORIES-1968.
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.

Inland Waters Br Water Surv of Canada Basic Data Rep, 1969. 13 p, 2 map, 2 tab, 2 index.

Descriptors: *Surface waters, *Stream gages, *Gaging stations, Data collections, Hydrologic data, Streamflow, Water levels.
Identifiers: *Canada, Yukon Territory, Northwest Territories.

Surface water stations in Yukon and Northwest Territories, Canada are listed. Station identification number, name, drainage area, gage location, availability of discharge records, type of gage, operation, recorder types, and remarks are tabulated. Station locations are shown by maps. (Knapp-USGS)
W69-08944

SURFACE WATER DATA REFERENCE INDEX OF ONTARIO-1968.
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.

Inland Waters Br Water Surv of Canada Basic Data Rep, 1969. 42 p, 2 map, 1 tab, 2 index.

Descriptors: *Surface waters, *Stream gages, *Gaging stations, Data collections, Hydrologic data, Streamflow, Water levels.
Identifiers: *Canada, Ontario.

Surface water stations in Ontario, Canada are listed. Station identification number, name, drainage area, gage location, availability of discharge records, type of gage, operation, recorder type, and remarks are tabulated. Station locations are shown by maps. (Knapp-USGS)
W69-08945

SURFACE WATER DATA REFERENCE INDEX OF SASKATCHEWAN-1968.
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.

Inland Waters Br Water Surv of Canada Basic Data Rep, 1969. 42 p, 2 map, 1 tab, 2 index.

Descriptors: *Surface waters, *Stream gages, *Gaging stations, Data collections, Hydrologic data, Streamflow, Water levels.
Identifiers: *Canada, Saskatchewan.

Surface water stations in Saskatchewan, Canada are listed. Station identification number, name, drainage area, gage location, availability of discharge records, type of gage, operation, recorder type, and remarks are tabulated. Station locations are shown by maps. (Knapp-USGS)
W69-08946

SURFACE WATER DATA REFERENCE INDEX OF ATLANTIC PROVINCES-1968.
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.

Inland Waters Br Water Surv of Canada Basic Data Rep, 1969. 22 p, 2 map, 5 tab, 2 index.

Descriptors: *Surface waters, *Stream gages, *Gaging stations, Data collections, Hydrologic data, Streamflow, Water levels.
Identifiers: *Canada, Atlantic Provinces.

Surface water stations in Atlantic Provinces, Canada are listed. Station identification number, name, drainage area, gage location, availability of discharge records, type of gage, operation, recorder type, and remarks are tabulated. Station locations are shown by maps. (Knapp-USGS)
W69-08947

SURFACE WATER DATA REFERENCE INDEX OF MANITOBA-1968.
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.

Inland Waters Br Water Surv of Canada Basic Data Rep, 1969. 42 p, 2 map, 1 tab, 2 index.

Descriptors: *Surface waters, *Stream gages, *Gaging stations, Data collections, Hydrologic data, Streamflow, Water levels.
Identifiers: *Canada, Manitoba.

Surface water stations in Manitoba, Canada are listed. Station identification number, name, drainage area, gage location, availability of discharge records, type of gage, operation, recorder type, and remarks are tabulated. Station locations are shown by maps. (Knapp-USGS)
W69-08948

SURFACE WATER DATA REFERENCE INDEX OF BRITISH COLUMBIA-1968.
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.

Inland Waters Br Water Surv of Canada Basic Data Rep, 1969. 134 p, 2 map, 1 tab, 2 index.

Descriptors: *Surface waters, *Stream gages, *Gaging stations, Data collections, Hydrologic data, Streamflow, Water levels.
Identifiers: *Canada, British Columbia.

Surface water stations in British Columbia, Canad
are listed. Station identification number, nam
drainage area, gage location availability
discharge records, type of gage, operatio
recorder type, and remarks are tabulated. Statio
locations are shown by maps. (Knapp-USGS)
W69-08949

**SURFACE WATER DATA OF ONTARIO - 196
WATER YEAR.**
Department of Energy, Mines and Resources, O
tawa (Ontario). Inland Waters Branch.

Inland Waters Br Water Surv of Canada Basic Da
Rep, 1966. 277 p, 2 fig, index.

Descriptors: *Data collections, *Surface water
*Streamflow, Stream gages, Lakes Reservoir
Stage-discharge relations.
Identifiers: *Ontario, Canada, Surface wat
records, Water quality records, Water resource
data.

The surface-water records for the 1966 water ye
for gaging stations, partial-record stations, a
miscellaneous sites in Ontario are presented. Th
data generally comprise a description of the statio
and a table showing the daily discharge a
monthly and yearly discharge of the stream. Th
description of the station gives the locatio
drainage area, records available, type and histo
of gages, average discharge, extremes of discharg
and general remarks. The type of gage currently
use and the datum of the gage above mean se
level, and a condensed history of the types, loc
tions, and datums of previous gages used during th
period of records available are listed. Informatio
on the accuracy of the records and condition
which affect the natural flow is given under 'R
marks.' Daily discharges, average discharge, e
tremes, yearly totals, and peak discharges are liste
in a table. (Knapp-USGS)
W69-08954

**FLOOD PLAIN INFORMATION, DELAWAR
CREEK, IRVING, TEXAS.**
Geological Survey, Washington, D.C.

Prepared for the city of Irving, Texas. Corps E
Flood Plain Rep, May 1969. 37 p, 5 fig, 7 plate,
tab.

Descriptors: *Floods, *Flood damage, *Texa
Flood plains, Flood control, Non-structural alte
natives, Maximum probable flood, Historic flood
Identifiers: Irving (Tex), Delaware Creek, Standa
project flood, Intermediate regional flood.

Flooding of the Delaware Creek, Irving, Texas
described in a report of flood plain problems bas
on records of rainfall, runoff, and historical a
present flood heights. Maps, photographs, profil
and cross sections indicate the extent of floodi
that has occurred and which may be expected
occur in the future. The information is for use
study and planning ways to minimize vulnerabil
of flood damages by control of flood plain use
zoning and subdivision regulations, the constr
tion of flood protection works, or by combinatio
of these approaches. (Knapp-USGS)
W69-08958

**FLOOD PLAIN INFORMATION, ST. JOH
RIVER, JACKSONVILLE, FLORIDA.**
Corps of Engineers, Jacksonville, Fla.

Prepared for consolidated city of Jacksonvil
Corps Eng Flood Plain Rep, Mar 1969. 71 p, 10
18 plate, 20 tab.

Descriptors: *Floods, *Flood damage, *Flori
Flood plains, Flood control, Non-structural alt
natives, Maximum probable flood, Historic flood
Identifiers: St Johns River, Jacksonville (Fl
Standard project flood, Intermediate regio
flood.

ling of the St. Johns River, Jacksonville, la is described in a report of flood plain ems based on records of rainfall, runoff, and ical and present flood heights. Maps, photo-s, profiles, and cross sections indicate the ex-f flooding that has occurred and which may pected to occur in the future. The information use in study and planning ways to minimize rability to flood damages by control of flood use by zoning and subdivision regulations, the ruction of flood protection works, or by com-ons of these approaches. (Knapp-USGS)
08959

Groundwater

RESEARCH OF FRESH WATER IN A NE ENVIRONMENT,
rimary bibliographic entry see Field 04B.
08686

ENERAL SUMMARY OF THE STATE OF EARCH ON GROUNDWATER HYDROLO-N DESERT ENVIRONMENTS,
na Univ., Tucson.
ne S. Simpson.
. McGinnies, B. J. Goldman, and Patricia re, Eds., Deserts of the World, an Appraisal search into their Physical and Biological En-ments, VIII, University of Arizona Press, Tuc-967. 18 p, 1 tab, 97 ref.

riptors: *Analog models, *Arid lands, undwater, *Evaluation, Hydrology, Aquifers, cial recharge management, Geohydrology, ogeology, Groundwater recharge, Water ta-Hydrologic budget, Water resources planning, arch and development, Water policy, Data ctions, Synthesis, Subsurface mapping, Water ge.

uthor presents a brief histroy of hydrology, an ation of the state of knowledge pertaining to ndwater in arid environs, and recommenda-on future research needs of sound water pol-rmation. Sources, accessibility, and reliability rtinent information are treated. The interrela-hip of the objectives of research to those of policy is stressed as is the need for systematic gement of groundwater resources (eg. Israel). vledge on aquifers, water budget, and aquifer rge in arid lands is evaluated in relation to the ms-analysis approach toward solution of water gement problems. The author concludes that ndwater hydrology 'is on the threshold of an rtant period of integration' and it is now sary and possible to synthesize, to exhibit the ioning system as a whole. Recommendations ture research needs in arid regions include nplementation of rational data collection pro-s in response to modern computer technology, ata on hydrogeologic mapping, basic relations en water chemistry and aquifer properties, mination of the distribution of hydraulic head ce and time (suggests development of auto-one year recording gage), (3) evaluation of ial recharge, this requires a probabilistic iption of stream flow for arid regions, (4) r funding. Includes large annotated bibliog-. (Sherbrooke-Ariz)
08688

SURING UNDERGROUND-EXPLOSION CTS ON WATER LEVELS IN SURROUND-AQUIFERS,
gical Survey, Denver, Colo.
Garber, and L. E. Wollitz.
nd Water, Vol 7, No 4, p 3-7, July-Aug 1969. fig, 6 ref.

iptors: *Water levels, *Groundwater, *Water *Nuclear explosions, *Water level fluctua-Measurement, Seismic waves, Aquifers, la.
fiers: *Nuclear explosion effects.

Underground detonations may produce observable effects in surrounding aquifers and wells. The nature and the duration of the effect at any observation point seem to depend on several factors such as the amount of energy released by the detonation, the geologic environment, the position of the buried explosive device in relation to the saturated zone, aquifer characteristics, and the distance from point of detonation. Precise measurement of these effects in wells presented numerous technical problems and resulted in the development of specialized techniques. Initially, these effects were observed by measuring the fluctuation of the free water surface in wells. The current technique employs high-resolution pressure transducers deep in the water column. Pneumatic packers may be used to restrict the movement of water into the well. Data are recorded on high-speed oscillographs. (Knapp-USGS)
W69-08701

FIELD USE OF ORIFICE METERS,
Geological Survey, Huron, S. Dak.
Donald G. Jorgensen.
Ground Water, Vol 7, No 4, p 8-11, July-Aug 1969. 4 p, 6 fig, 4 ref.

Descriptors: *Discharge (Water), *Measurement, *Flow measurement, *Orifices, Water wells, Discharge measurement, Flow rates, Orifice flow, Outlets, Pipes.
Identifiers: Pump discharge measurement.

A well-designed and calibrated orifice meter is an accurate and inexpensive measuring device for flow. Endline orifices can be calibrated at work sites by solving an equation that interrelates easily measured dimensions of the orifice and outflow. This paper summarizes the development of the discharge equation for circular orifices and describes a procedure for determining the coefficient of discharge under field conditions. (Knapp-USGS)
W69-08702

COMPOSITIONAL SIMILARITIES BETWEEN HOT MINERAL SPRINGS IN THE JORDAN AND SUEZ RIFT VALLEYS,
Israel Atomic Energy Commission, Rehovoth; and Weizmann Inst. of Science, Rehovoth (Israel).
For primary bibliographic entry see Field 02K.
W69-08709

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN NEW JERSEY.
Corps of Engineers, New York. North Atlantic Div.
For primary bibliographic entry see Field 08A.
W69-08710

VARIATIONS IN FILTRATION VELOCITY DUE TO RANDOM LARGE-SCALE FLUCTUATIONS OF POROSITY,
Moscow Inst. of Mechanical Problems (USSR).
Yu A. Buyevich, A. I. Leonov, and V. M. Safrai.
J Fluid Mech, Vol 37, Part 2, p 371-381, June 23, 1969. 11 p, 12 ref.

Descriptors: *Filtration, *Flow, *Porous media, *Groundwater movement, Porosity, Permeability, Mathematical studies, Turbulence, Laminar flow, Turbulent flow, Unsteady flow, Saturated flow, Diffusion.
Identifiers: Porosity variation, Porosity inhomogeneity.

The local porosity of a real porous material, obtained by averaging over volumes containing a sufficiently large number of pores, is different from the mean porosity of the material as a whole. This difference is caused by large-scale defects of the porous structure and can be treated as a random function of position in the porous material. Such a random deviation of the local porosity from the average value causes random local flows superimposed upon the mean filtration flow. The characteristic scale of such motion is much larger than that of the flow of a fluid through individual pores. The phenomenon appears to play an important role in transport processes in filtranion. The statistical characteristics of the random fields under consideration are determined on the basis of the assumption that the local porosity is a random function of position with independent increments. Expressions for correlati wns of various quantities are obtained in terms of the characteristics of porosity fluctu wtions, and the effective coefficients of diffusion caused by the random motions under study are estimated. (Knapp-USGS)
W69-08716

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN ALASKA, 1969.
Corps of Engineers, Portland, Oreg. North Pacific Div.
For primary bibliographic entry see Field 08A.
W69-08718

GROUND WATER HYDROLOGY FOR WATER WELL DRILLING CONTRACTORS,
Kent State Univ., Ohio. Dept. of Geology.
Jon L. Rau.
Kent State Univ Dep Geol Textbook Rep, 1968. 259 p, 514 ref.

Descriptors: *Groundwater, *Hydrogeology, *Water wells, Maps, Cross-sections, Stratigraphy, Aquifers, Structural geology, Hydrologic cycle, Artesian wells, Recharge, Water quality, Electrical studies, Surveys, United States.
Identifiers: *Groundwater prospecting, *Textbooks, Aquifer testing.

A textbook for water well drilling contractors presents the basic geologic factors controlling the occurrence, availability, and quality of groundwater. Groundwater hydraulics is not discussed in detail, but important references to it are listed. The hydrogeology of the Eastern United States is covered in better detail than that of other parts of the country. Some of the topics covered in detail are topographic maps, rock terminology, stratigraphic correlation, geomorphology, geologic maps, geologic structure, structural maps, cross sections, the hydrologic cycle, occurrence of groundwater, properties of aquifers, artesian water, induced infiltration, aquifer testing, recharge, groundwater prospecting, well logging, resistivity surveys, water quality, and groundwater in the eastern U.S. physiographic provinces. (Knapp-USGS)
W69-08722

SUBSURFACE FEEDING OF RIVERS IN THE NEMAN BASIN,
Ministry of Melioration and Water Resources Management (USSR).
For primary bibliographic entry see Field 02E.
W69-08730

WATER RESOURCES OF THE SCHUYLKILL RIVER BASIN,
Geological Survey, Harrisburg, Pa.
For primary bibliographic entry see Field 02E.
W69-08744

A LITERATURE SURVEY OF THE USE OF RADIOISOTOPES IN GROUND-WATER STUDIES,
Institute of Geological Sciences, London (England).
J. D. Mather.
Great Brit Inst Geol Sci Tech Commun No 1, 1968. 27 p, 1 fig, 1 tab, 121 ref.

Descriptors: *Groundwater, *Aquifers, *Radioisotopes, Water supply, Radioactive dating, Tritium, Carbon, Silica, Tracers, Porosity, Velocity, Rainfall, Strontium radioisotopes,

Seasonal, Plant physiology, Analytical techniques, Wells.
Identifiers: Radioisotopes in groundwater study.

A detailed survey is presented of the literature on radioactive dating of groundwater. Topics discussed include radioactive dating (tritium, carbon-14, and silicon-32), and radioisotopes as groundwater tracers. Preliminary tracer evaluations are made and field studies described. (Gabriel-USGS)
W69-08745

CAUSES OF FLUCTUATIONS IN THE RATE OF DISCHARGE OF CLEAR LAKE SPRINGS, MILLARD COUNTY, UTAH,
Geological Survey, Washington, D.C.
R. W. Mower.
Geol Surv Water-Supply Pap 1839-E, 1967. 31 p, 8 fig, 1 plate, 2 tab, 12 ref.

Descriptors: *Springs, *Discharge (Water), *Fluctuation, *Utah, Surface-groundwater relationships, Precipitation (Atmospheric), Basalts, Alluvium, Hydrogeology, Groundwater movement, Irrigation wells.
Identifiers: *Pavant Valley, Artesian aquifer.

To determine the relation of the rate of flow of Clear Lake Springs to weather conditions during 1959-1964 and to groundwater withdrawals in Pavant Valley, a hydrologic study was made of the spring area, Millard County, Utah. It was found that seasonal fluctuations in discharge rate of Clear Lake Springs are caused both by variations in the rate of groundwater recharge and by the related variations in the rate of pumping for irrigation in Pavant Valley. Withdrawal of groundwater from wells in the southern four districts causes seasonal reductions in the flow of the springs by reducing the hydraulic gradient between the wells and the springs. Average annual volume of spring discharge was 14,900 acre ft in 1960-1964. Water enters the very permeable basalt aquifer as direct recharge from precipitation, as interformational leakage from a contiguous artesian aquifer in lake and alluvial sediments, and as infiltration of infrequent flood runoff and of unconsumed irrigation water in the valley lowlands. A hydrograph of the spring flow and other data indicate that about 1/5 of the discharged water is from precipitation on the basalt outcrop of the aquifer. (Llaverias-USGS)
W69-08747

HYDROLOGIC CONDITIONS DURING 1966 IN DADE COUNTY, FLORIDA,
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 02E.
W69-08762

VOLUME OF AQUIFER TESTED FOR PERMEABILITY DURING A ONE-WELL PUMPING TEST,
Sanford I. Strausberg.
Ground Water, Vol 7, No 4, p 24-25, July-Aug 1969. 2 p, 2 fig, 6 ref.

Descriptors: *Groundwater movement, *Water yield, *Permeability, *Water wells, *Aquifers, *Nevada, Artesian wells, Water wells, Hydrogeology, Water levels, Water level fluctuations, Drawdown.
Identifiers: *Aquifer testing, *Pumping tests.

Pumping test data from a single well were used to estimate aquifer volume affecting drawdown. After 4 days of pumping from a 240 ft thick welded tuff aquifer in southern Nevada, the volume of the wedge-shaped mass tested was estimated to be about 15.6 billion cu ft. The field coefficient of permeability of the aquifer is 275 gpd/sq ft. (Knapp-USGS)
W69-08763

METHODS FOR CALCULATING THE COST OF DEVELOPING GROUND-WATER RESOURCES IN APPALACHIA,
Geological Survey, Charleston, W.Va.
Granville G. Wyrick.
Ground Water, Vol 7, No 4, p 21-23, July-Aug 1969. 3 p.

Descriptors: *Water resources development, *Appalachian Mountain Region, *Groundwater, Water wells, Water costs, Economics, Surveys, Reviews, Aquifers.
Identifiers: Appalachia.

The project developed between the U.S. Army Corps of Engineers, Office of Appalachian studies and the U.S. Geological Survey for a study of the groundwater resources in Appalachia had 2 principal objectives. The first objective was to describe in general terms the groundwater resources of the Region as a whole and the second objective was to describe in greater detail the groundwater resources at about 20 selected sites. The methods used to describe the Region as a whole are described with a special emphasis on availability and cost of developing groundwater, as was requested by the Office of Appalachian Studies. (Knapp-USGS)
W69-08764

EFFECTS OF LARGE-SCALE MINING WITHDRAWALS OF GROUND WATER,
North Carolina State Dept. of Water and Air Resources, Raleigh. Div. of Ground Water.
Harry M. Peek.
Ground Water, Vol 7, No 4, p 12-20, July-Aug 1969. 9 p, 8 fig, 7 ref.

Descriptors: *Water levels, *Groundwater, *Mine drainage, *Saline water intrusion, *Aquifers, North Carolina, Water level fluctuations, Artesian wells, Hydrogeology, Recharge, Groundwater movement, Water management (Applied).
Identifiers: Cone of depression.

Expanding water requirements during recent years have intensified development of the productive sedimentary aquifers of the North Carolina Coastal Plain. The effects of this development emphasize the need for an effective management program. Withdrawal of about 60 mgd from the Castle Hayne limestone, the most productive artesian aquifer of the area, began in July 1965 at a phosphate mine adjacent to the Pamlico River in Beaufort County. Within a few months, the artesian head was lowered below sea level in an area of about 800 sq mi, and to more than 100 ft below sea level in the immediate vicinity of pumping. Under these conditions the aquifer became vulnerable to encroachment of saline water from (1) areas of natural occurrence of brackish water in the limestone member of the aquifer; (2) leakage of brackish surface water through the confining beds; and (3) vertical movement of brackish water from the underlying sand member of the aquifer. The dramatic effects of the large withdrawals and the threat of damage to the aquifer created sufficient public concern so that legislation was passed giving the Board of Water and Air Resources authority to regulate groundwater withdrawals as needed. An adequate management program can be accomplished that will not only protect the aquifer but will improve the development potential. The development of such a management program requires a thorough knowledge of the hydrology of the aquifer system, the objective of studies in progress. The implementation of the program will require the support of an informed public. (Knapp-USGS)
W69-08765

THE APPLICATION OF GEOELECTRICAL METHODS TO GROUND-WATER EXPLORATION OF UNCONSOLIDATED METHODS TO GROUND-WATER EXPLORATION OF UNCONSOLIDATED FORMATIONS IN SEMI-ARID AREAS,
Z. Krulc, and M. Mladenovic.
Geoexploration, Vol 7, No 2, p 83-95, June 196
13 p, 8 fig, 34 ref.

Descriptors: *Groundwater, *Aquifers, *Electric studies, *Semiarid climates, Hydrologic properti Electrical properties, Hydrogeology, Soil physic properties, Structural geology, Salinity, Resistivit Boreholes, Geology, Alluvium, Limestones, Marl
Identifiers: *United Arabic Republic (Egypt) a Libya.

The application and interpretation are described geoelectrical methods utilized in the semiarid are of Egypt and Libya in exploration for water-bearı formations characterized by their poor consolid tion. Geoelectrical methods can be successfully a plied in semiarid regions for the solution of seve problems as follows: (1) the penetration of sali water into the dry land; (2) the separation of fre water lenses floating on saline water; (3) t establishment of the depth of water--impermeab basement; and (4) other pertinent problems. The problems can be often successfully solved by t use of resistivity techniques--geoelectrical soun ing and geoelectrical profiling. In the geoelectric sounding method a hydrogeological section is o tained at the observation points as well as the da concerning the depth of single horizons. If explor tion boreholes are available, the interpretation geoelectrical investigations becomes easier, mo accurate, and more reliable. (Gabriel-USGS)
W69-08770

INTERPRETATION OF THE RESULTS O HYDROGEOCHEMICAL PROSPECTING (RU SIAN),
S. D. Kapranov.
Izv Vysh Ucheb, Geol i Razved, No 4, p 82-87, A 1969. 6 p, 3 fig, 6 ref.

Descriptors: *Geochemistry, *Groundwat *Springs, *Exploration, Water chemist Mapping, Sampling, Mineral industry, Trace el ments, Organic matter.
Identifiers: *USSR, Sretensk.

The basic principals involved in the interpretati of hydrogeochemical surveys in search for miner ized areas are discussed, and their application described in a study of the mineralization of sprin and groundwaters of Sretensk district, Easte Transbaikal. The final survey map of mineraliz tion indicators should give the distribution of t following groups: (1) Si, Al, Fe, Ti; (2) Ca, Mg, N K, sulfate; (3) Zn, Cu, Mo, As; (4) Li, Rb, Cs, B and (5) Cl, F, I, Br, and B. The main problem in terpretation of the hydrochemical results is t identification of some regular connections betwe the distribution of characteristic elements a hydrochemical zoning of natural waters on o hand and the development of ore-formi processes in the area under study. (Gabriel-USGS
W69-08771

THE STUDY OF NON-LINEAR FLO THROUGH POROUS MEDIA BY MEANS ELECTRICAL MODELS,
Zagreb Univ. (Yugoslavia).
J. Baturic-Rubcic.
J Hydraul Res, Vol 7, No 1, p 31-65, 1969. 35 p. fig, 13 ref.

Descriptors: *Groundwater flow, *Porous med Non-uniform flow, *Electric analogs, *Model s dies, *Electrical networks, Groundwater, Mod Wells, Artesian wells, *Base flow, Darcy's Law, I tration, Permeability, Electric potential, Tv dimensional.
Identifiers: *Hydrologic models, Impervious lay Piezometric head.

A particular network configuration of pore media flow with appropriate electrically nonlin elements is introduced. Such a network enables vestigation on nonlinear and linear flows thro porous media by means of an electrical analo The network acts very approximately as an isotr ic and homogeneous continuous conducting me

n with similar properties to a porous medium. A dimensional network is realized. Some typical ses of arbitrarily curvilinear filtration of artesian lls and gravity-flow systems are modeled on this twork. For the sake of hydrodynamical in- rpretation of electrical models, similarity criteria e determined for the considered nonlinear flow, th the aid of which the changes that take place in original flow system due to transition for linear filtration nonlinear flow are observed and scussed. (USBR)
69-08848

STUDY OF GROUND-WATER RECHARGE ROM THE AKAGI AND HARUNA VOL- ANOES, GUMMA PREFECTURE (JAPANESE),
dustrial Science and Technology Agency, wasaki (Japan). Geological Survey.
ugio Ozaki, and Toshio Kanno.
ull Geol Surv of Japan, Vol 19, No 6, p 1-19, June 68. 19 p, 16 fig, 6 tab, 11 ref.

escriptors: *Groundwater, *Volcanoes, Groundwater recharge, Geology, Cities, scharge (Water), Hydrologic properties, rmeability, Water supply, Mapping, Geologic apping.
entifiers: *Japan, Akagi and Haruna Volcanoes.

is usually assumed that a part of groundwater charge of the aquifers supplying water to the ci- es of Maebashi and Takasaki depends on the area ntaining the Agaki and Haruna volcanoes. To eck this assumption, the authors decided to ob- in pertinent geological and hydrological data and use a method of specific discharge based on the stribution of geologically uniform units. The udy shows that: (1) the fundamental parameters ntrolling specific discharge depend upon the ck permeability and the conditions of water area; 2) a large quantity of recharge occurs in an area cated on the mountain slope; and (3) the amount recharge and its geographical position may be ughly estimated by using iso-specific discharge ntour maps. (Gabriel-USGS)
69-08894

TUDY OF INDUSTRIAL GROUND-WATER ESOURCES IN THE TSURUGA PLAIN, FUKUI REFECTURE (JAPANESE),
ndustrial Science and Technology Agency, awasaki (Japan). Geological Survey.
higeru Takahashi, and Hayaji Goto.
ull Geol Surv of Japan, Vol 19, No 6, p 33-46, ne 1968. 14 p, 12 fig, 4 tab, 2 ref.

escriptors: *Groundwater, *Water resources, Valleys, Cities, Artesian wells, Water supply, In- ustrial water, Industrial production, Groundwater charge, Groundwater movement, Pumping, ater levels, Boreholes, Hydrologic data, Geology, lapping.
lentifiers: *Japan, Tsuruga City, Fukui Prefec- re

roundwater resources present in the coastal plain ear the Tsuruga City were investigated by using ydrologic and geologic data. The study shows that ie Toyoboseki Co. factory is using 60,000 to 0,000 cubic meters of artesian water per day from 0 wells. The study also shows that the recharge ource of the artesian water is the streamflows of ie Shono-Kawa and Kuro-Kawa Rivers, and the ater level of the artesian wells declines with time nd at present is 6-7 m below the ground surface. In ie middle reaches of the Shono-Kawa River the epths of the wells vary from 120 to 150 m and the umping rate of a well of 10-12 inch hole size is bout 3,500 - 5,000 cu m/day. (Gabriel-USGS)
69-08895

HE EFFECT OF GEOLOGICAL STRUCTURE N THE CHEMICAL COMPOSITION OF ROUNDWATER IN THE POPOVO POLJE REA (FRENCH),
nergy Trust, Sarajevo (Yugoslavia).
oca Mladenovic.
Hydrol of fractured rocks Vol 2, Proc Dubrovnik Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74, p 645-653, 1967. 9 p, 3 fig, 1 map.

Descriptors: *Chemical properties, *Water properties, *Groundwater, *Geologic control, Structural geology, Water sources, Hydroelectric plants, Drainage, Groundwater movement, Surface-groundwater relationships, Rivers, Limestones, Dolomite, Sands, Hydrogeology, Sea water.
Identifiers: *Yugoslavia, Dalmatia, Coastal area.

The hydrochemical analysis of the waters of the Trebisnjica River, Dalmatia, was conducted for the purpose of evaluating the effects of water regime on springs located in the coastal area after the construction of a hydroelectric power station. The river basin, mainly consisting of limestones and dolmites, may be characterized as follows: (1) chemically, the groundwater consists of several types (bicarbonate of calcium, magnesium, sulfate, and chloride); (2) the chemical composition of groundwater is conditioned by the geological formations and by the effect of some marine conditions; (3) no underground channels exist between the river water and the high-altitude coastline between Slano and Neretva; and (4) the low-altitude coastline between Slano and Neretva is characterized by springs showing the existence of subterranean channels. (Gabriel-USGS)
W69-08896

WATER CHARACTERISTICS FROM SPRINGS IN THE LIMESTONE REGION OF CROATIA,
Institute of Sanitary Engineering, Zagreb (Yugoslavia).
Milivoj Petrik.
Hydrol of fractured rocks Vol 2, Proc Dubrovnik Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74, p 624-634, 1967. 11 p, 4 fig, 41 ref.

Descriptors: *Springs, *Spring water, *Limestones, Geochemistry, Carbon dioxide, Calcium, Magnesium, Chloride, Sulfates, Water temperature, Alkaline water, Aquifers, Hardness (Water), Dolomite, Karst, Geology, Mesozoic era, Tertiary period, Rivers.
Identifiers: *Yugoslavia, Croatia, Spring water characteristics.

Water from 100 springs located throughout the limestone region of Croatia was analyzed and the analytical results and other data are presented. Determinations were made of free carbon dioxide, dissolved oxygen, carbonate and non-carbonate hardness, alkalinity, magnesium, calcium, and chloride contents. Temperature of the spring waters varied between 4.8 and 18.0 deg C. Altitude of the springs sampled ranges from sea level to about 1000 m above sea level. Results of the study were summarized for smaller sub-regions and some general sub-regional and regional characteristics were indicated. A comparison was made between the underground water of this region and water localized in the finely-grained aquifers of non-karstic parts of Croatia. Some of the characteristics of waters from four rivers are given. (Gabriel-USGS)
W69-08897

HYDROCHEMICAL CHARACTERISTICS OF GROUNDWATERS IN SARMATIAN AND MEDITERRANEAN-II LIMESTONES IN THE VICINITY OF BELGRADE,
Belgrade Univ. (Yugoslavia). School of Mining and Geology.
N. Milojevic, B. Filipovic, and N. Dimitrijevic.
Hydrol of fractured rocks Vol 2, Proc Dubrovnik Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74, p 635-644, 1967. 10 p, 6 fig, 1 tab.

Descriptors: *Chemical properties, *Hydrologic properties, *Hydrogeology, *Groundwater, Limestones, Thermal properties, Tertiary period, Karst, Springs, Sinks, Fissures (Geology), Porosity, Water table, Hydrogen sulfide, Chlorides, Sodium, Potassium, Magnesium, Water types.
Identifiers: *Yugoslavia.

This paper discusses the effect of geological and other factors, such as the processes of leaching and infiltration, on the hydrochemical characteristics of groundwater. The origin of particular types of groundwater is also presented. The chemical composition of sodium hydrocarbonate type of waters depends on the original composition of waters subjected to desulfatization and on the chemical composition of rocks subjected to leaching. Factors that affect the composition of ground waters are: the original composition, rock porosity, rock composition, the presence of NaCl as a result of the 'struggle' between marine and continental environments, and the physiochemical laws operating in the processes of accumulation and movement of groundwaters. Diagrams and profiles illustrate the basic hydrochemical characteristics and a classification of the groundwater is given. (Gabriel-USGS)
W69-08898

SOLUBILITY RELATIONSHIP OF LIMESTONES AND DOLOMITES (FRENCH),
Institute for Geological and Geophysical Research, Belgrade (Yugoslavia).
Dragoljub Zogovic.
Hydrol of fractured rocks Vol 2, Proc Dubrovnik Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74, p 615-623, 1967. 9 p, 3 fig, 5 tab, 9 ref.

Descriptors: *Solubility, *Limestones, *Dolomite, Natural flow, Karst, Aquifers, Carbonate rocks, Physicochemical properties, Crystalline rocks, Crystallization, Hydrogeology, Thermodynamic behaviour, Sulfates, Anhydrite, Calcite, Gypsum, Acidic waters.
Identifiers: *Solubility relationship, Hydrochemical properties.

The solubility of limestones and dolomites, as the main factor in forming karstic areas, is critically reviewed on the basis of earlier investigations by Lehman (1932, Leipzig and Wien), Leitmeier (1916, Stuttgart), Ogiljvi (1956, Moscow), Sokolov (1962, Moscow) and others. It is concluded that rock solubility depends mainly on the nature of crystal material where the energy of crystal lattice is of primary importance. The structure of calcareous rocks, the presence of various impurities and the character of a solvent strongly affect the solubility process. The degree of solubility of limestone and dolomite rocks depends on the hydrochemical and thermodynamic properties of aqueous solutions present in the karstic areas. (Gabriel-USGS)
W69-08899

TRACER DYNAMICS IN LAMINAR FLOW THROUGH POROUS MEDIA (ROMANIAN),
Academia R. P. R., Bucharest. Institutul de Fizica Atomica.
Emilian Gaspar.
Hidrotehnica, Gosp Apelor, Meteorol, Vol 13, No 6, p 298-303, June 1968. 6 p, 5 fig, 3 tab, 19 ref.

Descriptors: *Tracers, *Radioisotopes, *Laminar flow, *Porous media, Analytical techniques, Tracking techniques, Radioactive dating, Rock properties, Adsorption, Absorption, Permeability, Ion exchange.
Identifiers: *Tracer dynamics, Groundwater reservoir.

The paper discusses the use of tracer methods to solve hydrological problems. The dynamics of stable or radioactive tracers in groundwater is a very complicated process which cannot be entirely predicted. Laboratory experiments indicated that the concentration of radioactive tracers is a function of percolation time, length of soil column, average velocity, and longitudinal dispersion constants. The chemical, physical, and hydrological aspects of tracer and water movement through porous media should be known to evaluate the usefulness of tracer techniques in hydrology. The tracer can be retained by various geologic formations by adsorption, absorption, and ion exchange phenomena.

Tracer solubility in water, density, viscosity, and surface tension of tracer solution as well as the porosity and permeability of percolating media control to a large extent the movement of radioactive tracers in aquifer formations. Thermal and pressure variations within the water-bearing formations play an important role on hydrodynamic phenomena. There is a recognized need for basic research dealing with the use of radioisotopes in order to solve important hydrologic problems. (Carstea-USGS)
W69-08901

RECORDS OF WELLS AND SPRINGS, SAN ANTONIO AREA, TEXAS,
Geological Survey, Washington, D.C.
Paul Rettman.
Texas Water Develop Board-Edwards Underground Water Dist Rep, May 1969. 28 p, 6 fig, 1 tab, 7 ref.

Descriptors: *Water wells, *Springs, *Data collections, *Texas, Aquifers, Limestones, Water yield, Water levels, Water utilization.
Identifiers: Well data collections, *San Antonio (Tex), Edwards Limestone.

Records of wells and springs in the San Antonio area, Texas are tabulated. Most of the wells produce water from the Edwards and associated limestones. Each record consists of well number, owner's name, date completed, depth, diameter, depth to openings, length open to aquifer, finish, logs available, aquifers, land surface, altitude, depth to water, data of measurement, use of water, use of well, type of lift, power, and yield. Maps show well and spring locations. (Knapp-USGS)
W69-08903

HYDROLOGICAL YEAR-BOOK OF ISRAEL 1966-67.
Ministry of Agriculture, Jerusalem (Israel). Hydrological Service.
For primary bibliographic entry see Field 02E.
W69-08908

GROUND WATERS AND SURFACE WATERS OF THE BURIAT-MONGOLIAN A.S.S.R. AS A SOURCE OF AGRICULTURAL WATER SUPPLY (RUSSIAN),
G. V. Kopanev.
Izdatel'stvo Akad Nauk, SSSR, Moscow, 1960. 152 p, 24 fig, 11 tab, 80 ref.

Descriptors: *Agriculture, *Runoff, *Aquifers, Topography, Climates, River basins, Hydrologic data, Gaging stations, Hydrogeology, Mineral water, Water supply, Water utilization, Geology, Pollutants, Water chemistry, Water analysis, Water structure.
Identifiers: *USSR, Buriat, A.S.S.R. water resources.

Agricultural water supply in the Buriat-Mongolian A.S.S.R. was investigated on the basis of several earlier publications. The report describes general physical geography of the region and several chapters are devoted to the geohydrological conditions and agricultural potential. Surface water and groundwater relationships, runoff characteristics, and climate are discussed. The geology, groundwater types, regimes, and water quality are described. River systems, runoff distribution (both annually and periodically), and irrigation for pasture and other crops are discussed. (Gabriel-USGS)
W69-08912

RADIOACTIVE TRACERS IN HYDROLOGICAL RESEARCHES IN USSR,
Moscow State Univ. (USSR).
For primary bibliographic entry see Field 02E.
W69-08913

THE EFFECTS OF TEMPERATURE AND DENSITY GRADIENTS UPON THE MOVEMENT OF CONTAMINANTS IN SATURATED AQUIFERS,
Alabama Univ., University. Dept. of Engineering Mechanics.
Harold R. Henry.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 54-65, 1968. 12 p, 4 fig, 26 ref.

Descriptors: *Saturated flow, *Diffusion, *Dispersion, *Convection, *Groundwater movement, Solutes, Wastes, Path of pollutants, Mathematical models, Currents (Water), Mass transfer, Aquifers.
Identifiers: Thermal gradients.

The effects of gradients in temperature and density on the movement of contaminants in groundwater were studied by imposing a horizontal lateral temperature gradient on a tube of square cross section containing water-saturated sand. A convection current increased in strength as the temperature gradient increased. The effective value of thermal diffusivity was about 50 times larger than the expected value because of dispersion caused by the movement of water through tortuously interconnected interstices of the sand. (Knapp-USGS)
W69-08921

HEAT CONDUCTIVITY OF WATER-BEARING SATURATED ROCKS AS A FUNCTION OF PRESSURE, TEMPERATURE, AND ROCK COMPOSITION (RUSSIAN),
Akademiya Nauk SSSR
E. M. Bayramov, and A. B. Tsaturyants.
Izv Akad Nauk, Azerbaidzh. SSR, No 1, p 25-29, 1969. 5 p, 5 fig, 4 ref

Descriptors: *Aquifers, *Groundwater, *Saturation, *Pressure, *Water temperature, *Rock properties, Geology, Exploitation, Air temperature, Porosity, Oil reservoirs, Moisture, Moisture content, Sampling, Clays, Sands, Bore holes.
Identifiers: USSR.

Heat conductivity of water-bearing and oil-bearing sedimentary rocks was experimentally investigated by using several combinations of clay and sand at various temperatures and pressures. Experimental arrangement and technique used was in accordance with a method developed by A. K. Abaszade, A. A. Gylmanov, and E. M. Bayramov (1965), with temperatures and pressures up to 80 deg C and 1,500 atm, respectively. Five graphs of heat conductivity versus pressure and rock composition, based on the experimental data, are given in the article. (Gabriel-USGS)
W69-08926

MONSOON OVER THE INDUS VALLEY DURING THE HARAPPAN PERIOD,
Council of Scientific and Industrial Research, New Delhi (India).
C. Ramaswamy.
Nature, Vol 217, No 5129, p 628-629, Feb 17, 1968. 2 p, 1 fig, 12 ref.

Descriptors: *Paleohydrology, *Paleoclimatology, *Monsoons, Groundwater, History, Quarternary period, Radioactive dating, Precipitation (Atmospheric).
Identifiers: *India, *Indus Valley, Harappan period.

Archaeological and hydrogeological studies show that the climate in the Indus Valley in the Harappan period (2500-1700 BC) was much wetter than the present climate. Detailed study of the 500, 300, and 200 harts suggests that quasi-stationary troughs occasionally extended into the area and induce monsoon activity. In the Harappan period such troughs must have extend more frequently into the Indus Valley than at present. Recent discovery of considerable groundwater reserves supports this idea. The C-14 age of the water is about 5,000 yr BP. (Knapp-USGS)
W69-08950

SINUOSITY IN LIMESTONE SOLUTION C DUITS,
Pennsylvania State Univ., University Park. Dep Geology and Geophysics; Pennsylvania State U University Park. Materials Research Lab.; Pennsylvania State Univ., University Park. Dep Geochemistry and Mineralogy.
George H. Deike, and William B. White.
Amer J Sci, Vol 267, No 2, p 230-241, Feb 19 12 p, 5 fig, 2 tab, 23 ref.

Descriptors: *Channel morphology, *K *Caves, *Missouri, *Kentucky. Closed con flow, Drainage, Limestones, Underground, Stre flow, Meanders.
Identifiers: Cave sinuosity, European caves.

Cave passages are regarded as segments drainage conduits, and those with sinuous patt are compared with the meander belts of surf streams. Caves were sampled from central K tucky, Missouri, and various Appalachian and ropean reports. Caves that exhibited para uniform walls which did not branch in the m sured reach were selected. Two types of m linearity were found: an angulate form genera by water flow down a hydraulic gradient diago to a rectangular joint set and a curvilinear fo with sweeping S-bends apparently related to me ders in surface streams. The average bend spac and channel width of the sinuous form are rela by a power function. The constants are simila those proposed for alluvial rivers. (Knapp-USGS
W69-08952

GROUNDWATER--A NEGLECTED RESOUR
Geraghty and Miller, Port Washington, N.Y.
For primary bibliographic entry see Field 06D.
W69-09004

2G. Water in Soils

COMPUTER PROGRAM FOR CONVERTI NEUTRON PROBE READINGS TO SO WATER EQUIVALENTS,
Forest Service (USDA), New Orleans, Southern Forest Experiment Station.
For primary bibliographic entry see Field 07B.
W69-08639

IMPROVED STANDARDS FOR NEUTRON SO WATER METERS,
Forest Service (USDA), Oxford, Miss. South Forest Experiment Station.
For primary bibliographic entry see Field 07B.
W69-08640

SOIL-MOISTURE TRENDS AFTER THINNI AND CLEARCUTTING IN A SECON GROWTH PONDEROSA PINE STAND IN T BLACK HILLS,
Forest Service (USDA), Fort Collins, Colo. Roc Mountain Forest and Range Experiment Station
Howard K. Orr.
USDA Forest Serv Res Note RM-99, 1968. 8 p. lus.

Descriptors: *Evapotranspiration, *Moistu deficit, *Percolation, *Retention, Moisture co tent, Moisture availability, Gravitational wat Forest management, Water conservation, Sou Dakota.
Identifiers: Black Hills.

Thinning from 190 square feet basal area a nearly 2,000 trees per acre to 80 square feet a 435 trees did not induce free water seepage in o years when the unthinned stand did not yi seepage. Thinning reduced the soil moisture dep tion potential, however, seepage depends enough input moisture to overcome soil moistu deficits. Clearcutting and maintenance in bare co dition did induce free water seepage even in o years. (Author)
W69-08647

SOIL MOISTURE CONSTANTS AND PHYSICAL PROPERTIES OF SELECTED SOILS IN HAWAII,
Forest Service (USDA), Honolulu, Hawaii. Pacific Southwest Forest and Range Experiment Station.
Teruo Yamamoto.
US Forest Service Research Paper PSW-P2, 10 p, 1963. 4 fig, 4 tables, 20 ref.

Descriptors: *Soil moisture, *Soil physical properties, Hawaii, Land use, *Soil surfaces, Atterberg limits, Bulk density, Soil density, Specific gravity, Soil groups, Soil investigations.
Identifiers: Tropical soils.

The surface foot of 25 soils in 10 great soil groups were sampled. Surface vegetation, soil texture, Atterberg limits, bulk density, organic matter content, specific gravity, pH, and soil moisture constants are reported. (Merriam-Forest Serv)
W69-08648

WATER REPELLENT SOILS AND THEIR RELATION TO WILDFIRE TEMPERATURES,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
L. F. DeBano, and J. S. Krammes.
Bulletin of the I.A.S.H., XI Annee No 2, p 14-19, 1966.

Descriptors: *Waterproofing, *Soil temperature, *Burning, *Wettability, Infiltration, Soil erosion, Heat treatment, Soils, Watershed management, Overland flow, Heat transfer, Thermal conductivity.
Identifiers: Water repellent soils, Wildfires, *Non-wettable soils.

A naturally occurring water resistant soil was exposed to different burning times and temperatures after which the soil samples were tested for non-wettability. The less intense treatments produced an extremely non-wettable condition. Temperatures of 800 and 900 degrees applied for 20 minutes completely destroyed the non-wettable property. Heat treatments within the realm of soil temperatures existing during wildfires were capable of producing the extreme non-wettable condition. The increased surface runoff and erosion from burned southern California watersheds could be the result of this relationship. (DeBano)
W69-08657

FORMATION OF NON-WETTABLE SOILS...INVOLVES HEAT TRANSFER MECHANISM,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Leonard F. DeBano.
US Forest Serv Res Note PSW-132, 1966. 8 p.

Descriptors: *Heat transfer, *Heat treatment, *Condensation, *Wettability, Waterproofing, Soil erosion, Burning, Soil temperature, Shrubs, Chaparral, Sands, Laboratory tests.
Identifiers: Hydrophobic substances, Vaporization and condensation.

After a wildfire, some brushland soils in southern California have been found to include a non-wettable layer. This formation may be the result of hydrophobic material volatilizing and later condensing. In burning experiments, hydrophobic substances from ceanothus litter and non-wettable soil were moved downward into an underlying wettable sand by temperature gradients. The wettable sand acquired a marked resistance to wetting after the burning treatment. (Author)
W69-08658

SOIL WETTABILITY AND WETTING AGENTS...OUR CURRENT KNOWLEDGE OF THE PROBLEM,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Leonard F. DeBano, Joseph F. Osborn, Jay S. Krammes, and John Letey, Jr.
US Forest Serv Res Paper PSW-43, 1967. 13 p.

Descriptors: *Soils, *Wettability, *Surfactants, *Soil erosion, Burning, Waterproofing, Wetting, Grasses, Soil temperatures, Vegetation establishment, Heat transfer, Overland flow, Evaporation, Infiltration, Chaparral, Watershed management.
Identifiers: Hydrophobic substances, Wildfires, *Non-wettable soils.

Soils that resist wetting are a widespread phenomenon on chaparral areas of southern California watersheds. On burned watersheds, non-wettable soils markedly reduce moisture movement during both evaporation and infiltration. The reduced infiltration rate probably contributes significantly to the high debris production from the watersheds. Factors involved in the formation of non-wettable soils include vegetation and soil temperatures during fire. Wetting agents applied to burned areas apparently help retard debris movement and enhance vegetation establishment. (Authors)
W69-08659

SEED GERMINATION AND ESTABLISHMENT AS AFFECTED BY NON-WETTABLE SOILS AND WETTING AGENTS,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station; and California Univ., Riverside.
J. Osborn, J. Letey, L. F. DeBano, and Earl Terry.
Ecology, Vol 48, No 3, p 494-497, 1967.

Descriptors: *Germination, *Surfactants, *Vegetation establishment, *Wettability, Waterproofing, Grasses, Wetting, Seeds, Infiltration, Soil moisture, Slopes, Laboratory tests, Overland flow, Soils.
Identifiers: *Non-wettable soils, Seed germination, Annual ryegrass.

To study the effects of soil wettability and wetting agents on seed germination and establishment, three substrates (naturally occurring non-wettable soil, wettable soil, and a wettable quartz sand) were placed in small plastic containers and received applications of wetting agent in liquid, wetting agent on perlite, and no treatment as a control. The containers were seeded to wimmera ryegrass and were placed both on a 30 deg slope and on the level in a controlled temperature chamber (70 deg F). Seed placed on non-wettable soil which received no wetting agent treatment failed to germinate in those containers placed on the slope. Good germination occurred on soil which was treated with a wetting agent and on wettable sand. The same relationships occurred for the plants which were allowed to become established. Differences are primarily due to water relations; water ran off the sloping non-wettable soils. Wetting agent treatment on the wettable sand reduced both germination and establishment of the tested plants. (DeBano)
W69-08660

SOIL MOISTURE DEPLETION PATTERNS AROUND SCATTERED TREES,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Robert R. Ziemer.
US Forest Serv Res Note PSW-166, 1968. 13 p, illus.

Descriptors: *Soil moisture, *Evapotranspiration, Soils, Watershed management, California, Water conservation, Neutron meters, Vegetation effects, Moisture deficits.
Identifiers: *Soil moisture depletion, Pinus lambertiana.

Soil moisture was measured around an isolated mature sugar pine in the mixed conifer type of the central Sierra Nevada, California. Total moisture depletion from the 61-foot radius plot for the 1966 summer depletion season was 22.57 inches. (Author)
W69-08665

THE TESTING OF A METHOD FOR PREDICTING WATER INTAKE INTO SOILS BY THE USE OF FIELD CORES,
Purdue Univ., Lafayette, Ind. Water Resources Research Center.
Royce L. Lambert.
Doctor of Philosophy Thesis. Department of Agronomy, Purdue University. 100 p, 27 fig, 10 tab, 64 ref, 1 append. OWRR Proj No A-010-IND.

Descriptors: *Infiltration, Hydraulic, Conductivity, Infiltrometer, *Soil physical properties, Soil structure, Soil texture, Soil types, *Soil water, Vegetative effects, Approximation methods.
Identifiers: Green-Ampt Equation.

An approximate theory method for predicting infiltration based on the Green-Ampt equation was tested as to its applicability for use in the field. Field cores were taken into the laboratory and evaluated as to their water intake rates and then these values related to the parameters from the approximate theory equation. The infiltration rates as calculated by the approximate theory method were then related to those rates determined in the field by a sprinkling infiltrometer. The findings were that although the infiltration rates determined by the approximate theory method and those in the field were relatively similar, the values for the parameters involved in the equation were such they did not have any physical significance. This deviation was attributed to the wide variance in the physical structure of the soil in the field cores. (Wiersma-Purdue)
W69-08694

GEOLOGICAL CONDITIONS FOR THE FORMATION OF PEAT-BOGS OF THE CENTRAL PART OF WESTERN SIBERIA (RUSSIAN),
Moscow State Univ. (USSR). Dept. of Soil Science and Engineering Geology.
A. I. Sergeyev.
Vestnik Moskov Univ Nauch Zh, Ser 4, No 2, Geol, p 95-100, Mar-Apr 1969. 6 p, 2 fig, 2 tab, 5 ref.

Descriptors: *Geology, *Peat, *Bogs, Geomorphology, River basins, Flood plains, Clays, Sands, Lignite, Climates, Organic matter, Temperature, Chemical analysis, Sediments, Hydrologic properties, Forests, Salinity, Calcium, Carbonates, Lakes.
Identifiers: *USSR, Western Siberia, Peat bogs.

Geology and chemical composition of peat and peat waters of Western Siberia were investigated for the purpose of understanding the processes of their formation. The study of marsh-water indicates a gradual increase in pH and mineralization content from upper layers to the lower peat layers. Peat in the upper layers is formed under the prevailing acid conditions, whereas the lower peat layers are formed in the akaline or weakly-acidic media. Favorable climatic conditions, weak relief, and the presence of certain bedrocks can be considered as the main factors influencing the development of peat-bogs in Western Siberia. (Gabriel-USGS)
W69-08700

SULPHATE REDUCTION IN WATERLOGGED SOILS,
Rothamsted Experimental Station, Harpenden (England).
For primary bibliographic entry see Field 02K.
W69-08754

THE EFFECT OF THE CONCENTRATION AND MOVEMENT OF SOLUTIONS ON THE SWELLING, DISPERSION, AND MOVEMENT OF CLAY IN SALINE AND ALKALI SOILS,
Reading Univ. (England). Dept. of Soil Science.
D. L. Rowell, D. Payne, and N. Ahmad.
J Soil Sci, Vol 20, No 1, p 176-188, Mar 1969. 13 p, 6 fig, 14 ref.

Descriptors: *Expansive soils, *Ion exchange, *Water chemistry, *Alkaline soils, *Saline soils, Permeability, Hydraulic conductivity, Expansive clays, Impervious soils, Electrolytes, Montmorillonite, Adsorption, Laboratory tests, Soil mechanics, Dispersion, Diffusion.
Identifiers: Swelling clays, Swelling soils.

Changes in permeability of a soil containing montmorillonite, and the swelling of orientated aggregates of extracted clay have been found and compared with the concentrations at which aggregates dispersed in stationary solutions, and the concentrations at which soil suspensions dispersed when shaken. The results indicate that: (a) permeability begins to decrease at the same concentrations as the clay begins to swell, (b) the changes in permeability are directly controlled by the swelling of clay until clay dispersion and movement begins, (c) the concentration at which clay disperses depends on the mechanical stress applied, (d) when small mechanical stresses are applied, the proportion of the clay which swells and disperses depends directly on the exchangeable sodium percentage, and (e) large mechanical stresses may disperse most of the clay even at low exchangeable sodium percentages. (Knapp-USGS)
W69-08755

THE CONSTRUCTION OF CALIBRATION CURVES FOR DETERMINING WATER CONTENT FROM RADIATION COUNTS,
East Malling Research Station, Maidstone (England).
D. A. Holland.
J Soil Sci, Vol 20, No 1, p 132-140, Mar 1969. 9 p, 2 fig, 22 ref.

Descriptors: *Nuclear moisture meters, *Calibrations, *Statistical methods, Instrumentation, Measurement, Regression analysis, Soil moisture, Moisture content, Soil moisture meters, Radiation.
Identifiers: Nuclear soil moisture meters, Calibration curves.

The application of regression theory to the construction of calibration curves for the estimation of water content from an observed radiation count is possible only when the relationship between count and water content is linear, a homogeneous error applies to the dependent variate, count, whatever its value, and the independent variate, water content, is determined free of error. Determination of the errors of estimation is further complicated by the necessity to fit the regression of count, as the dependent variate, on water content and then to invert the equation in order to estimate moisture content from count. It is shown that these requirements can be fulfilled by an initial transformation of the data and by repeated subsampling for the determination of water content. A method is given for calculating errors of estimation. Experimentally, it was found that a transformation (logarithmic) was necessary when calibrating a beta-gage for leaf moisture measurement. When calibrating a neutron probe for soil-moisture measurement no transformation was required, but it was necessary to take repeated subsamples for water content determinations. (Knapp-USGS)
W69-08756

INFLUENCE OF TEXTURE ON THE MOISTURE CHARACTERISTICS OF SOIL: RELATIONSHIPS BETWEEN PARTICLE-SIZE COMPOSITION AND MOISTURE CONTENTS AT UPPER AND LOWER LIMITS OF AVAILABLE-WATER,
National Vegetable Research Station, Wellesbourne (England).
P. J. Salter, and J. B. Williams.
J Soil Sci, Vol 20, No 1, p 126-131, Mar 1969. 6 p, 2 tab, 8 ref.

Descriptors: *Moisture content, *Soil moisture, *Soil texture, Soil physical properties, Soil chemical properties, Regression analysis, Particle size, Porosity, Permeability, Organic matter, Soil classifications, Equations.
Identifiers: *Soil moisture-texture relationships.

A quantitative assessment was made of the effect of the proportion of sand, silt, clay, and organic matter in 26 soils on the moisture contents at the upper and lower limits of available-water of the soils. Regression equations were obtained which enabled the moisture contents to be estimated on a weight or volume basis from mechanical analysis data using either International or American size grades. The accuracy of estimating the upper limit of available-water from the various equations ranged from 9 to 22% for the lower limit, from 8 to 16% of the measured values. Mean values of the moisture contents at the upper and lower limits of available-water for each textural class were calculated from the average particle-size composition for each class and from the regressions obtained. (Knapp-USGS)
W69-08757

THE EFFECT OF HYSTERESIS OF PORE-WATER ON THE HYDRAULIC CONDUCTIVITY,
Agricultural Coll. of Athens (Greece). Dept. of Agricultural Chemistry.
A. Poulovassilis.
J Soil Sci, Vol 20, No 1, p 52-56, Mar 1969. 5 p, 2 fig, 16 ref.

Descriptors: *Soil water movement, *Hysteresis, *Hydraulic conductivity, Wetting, Water yield, Drying, Specific retention, Specific yield, Moisture content.
Identifiers: Hysteresis--hydraulic conductivity, Pore water.

It is pointed out with the help of the Independent Domain Theory that a fraction of pore-water is contained in pores not common to both the wetting and drying states and that this volume in a wetting state is contained in pores whose draining radii are greater than those of the pores in the drying state. It is suggested that hysteresis may affect the hydraulic conductivity through differences of the radii of the pores which tend to endow a wetting state with a conductivity greater than that of an equally wet but drying state; secondly, through differences of the coordinates of the above-mentioned pores, which may influence the paths of flow and consequently the hydraulic conductivity, and will have either a similar or opposite effect. It is concluded, therefore, that the conductivity in the wetting state can be greater, equal, or even less than that in the drying state, depending on the particular porous body. (Knapp-USGS)
W69-08760

INFILTRATION AS INFLUENCED BY TILLAGE-INDUCED RANDOM ROUGHNESS AND PORE SPACE,
Agricultural Research Service, Morris, Minn. Soil and Water Conservation Research Div.
R. E. Burwell, and W. E. Larson.
Soil Sci Soc Amer Proc, Vol 33, No 3, p 449-452, May-June 1969. 4 p, 3 fig, 3 tab, 9 ref.

Descriptors: *Infiltration, *Rainfall-runoff relationships, *Soil erosion, *Cultivation, Soil texture, Runoff, Soil physical properties, Permeability, Porosity, Soil conservation, Soil mechanics, Soil stabilization, Surface runoff, Erosion control.
Identifiers: Erosion index, Random roughness.

During simulated rainfall, increases in tillage-induced random roughness and pore space increased water infiltration before runoff started but did not significantly influence infiltration throughout a 5-cm runoff period. Random roughness provided a greater accounting of infiltration variation among tillage treatments to initial runoff than did total pore volume of the tilled layer. Freshly turnplowed alfalfa-bromegrass sod on Barnes loam and Nicollet sandy clay loam soil provided random roughness and pore space conditions that could accommodate without 'failure' the major portion of rainfall energy (as evidence by EI) expected in west central and southwestern Minnesota during the first 2 months following row crop planting. This is the critical r noff-erosion period in the Corn Belt. (Knap USGS)
W69-08935

RECESSION OF PERMAFROST IN A CU TIVATED SOIL OF INTERIOR ALASKA,
Alaska Agricultural Experiment Station, Palm and Soil Conservation Service, Palmer, Alaska.
Arvo Kallio, and Samuel Rieger.
Soil Sci Soc Amer Proc, Vol 33, No 3, p 430-4
May-June 1969. 3 p, 1 fig, 3 tab, 9 ref.

Descriptors: *Permafrost, *Thawing, *Cultivati *Alaska, Soil physical properties, Soil temperatu Soil water, Soil structure, Freezing, Cold regio Frozen ground.
Identifiers: Tanana soil series, Pergelic soils.

Soil temperatures above and within the perennia frozen zones of Tanana silt loam, a member of t subgroup of Pergelic Cryaquepts, were measur twice-weekly over a period of 3 years undisturbed, cleared, perennial grass, and pot plots. The permafrost table receded rapidly fro depth of about 1 m to almost 5 m after clearin Refreezing in autumn and winter takes place sim taneously downward from the surface and upwa from the new permafrost table. In the potato pl an unfrozen zone remained throughout the wint Mean annual temperatures above the new p mafrost table are warmer than 0 deg C. Some re sion in the definition of Pergelic subgroups in t Comprehensive Classification System seems nec sary to avoid a change in classification of the soil a result of clearing and cropping. (Knapp-USGS)
W69-08936

INFLUENCE OF THE COPPER, ZINC, IRO AND ALUMINUM SALTS OF SOME MICRO AL AND PLANT POLYSACCHARIDES ON A GREGATION AND HYDRAULIC CONDUCTIV TY OF RAMONA SANDY LOAM,
California Univ., Riverside. Dept. of Soils and Pla Nutrition.
J. P. Martin, and S. J. Richards.
Soil Sci Soc Amer Proc, Vol 33, No 3, p 421-4
May-June 1969. 3 p, 3 tab, 17 ref.

Descriptors: *Hydraulic conductivity, *Wa chemistry, *Ions, *Organic compounds, *S structure, Wettability, Ion exchange, Soil physi properties, Soil chemical properties, Soil a gregates.
Identifiers: Polysaccharides.

The influence on soil aggregation and hydrau conductivity of some microbial and pla polysaccharides and their Fe, Al, Cu, and Zn sa was determined. Specific effects were depende upon the polysaccharide and the metal ion. general, Fe and Al sharply reduced the effecti ness while Cu and Zn slightly reduced, exerted lit effect or increased their binding acti Chromobacterium violaceum polysaccharide a Karaya gum improved both aggregation a hydraulic conductivity. The polysaccharides fr Azotobacter indicus and Arthrobacter viscosus creased aggregation but did not alter hydrau conductivity. Azotobacter chroococcu polysaccharide in concentrations up to 0.1% i proved hydraulic conductivity but did not affect a gregation while ammonium-alginate exerted no fect on either soil property. (Knapp-USGS)
W69-08937

CONTRIBUTION OF SOME SOIL FUNGI T NATURAL AND HEAT-INDUCED WATE REPELLENCY IN SAND,
California Univ., Riverside. Dept. of Soils and Pla Nutrition.
S. M. Savage, J. P. Martin, and J. Letey.
Soil Sci Soc Amer Proc, Vol 33, No 3, p 405-40
May-June 1969. 5 p, 3 fig, 3 tab, 15 ref

criptors: *Infiltration, *Permeability, *Wetta-
y, *Soils, *Fungi, Temperature, Soil water
ement, Sands, Wetting, Soil chemical proper-
Soil physical properties.
ntifiers: *Water repellent soils.

it species of fungi isolated from a water repel-
soil were incubated for varying periods of time
lica sand. In their latter stages of growth, two of
fungi, Aspergillus sydowi and Penicillium
icans, cause limited water repellency in the
d. All the fungal sand cultures exhibited water
ellency when heated briefly at temperatures
veen 200 C and 400 C. The times required to
duce and destroy water repellency in the sand
ures at the various temperatures were similar to
se required by the natural soil from which the
gi were isolated. The fungal sand cultures and
ural water repellent soils were extracted with
er water, methanol, acetone, or ethyl ether.
methanol and water extractions destroyed the
ural water repellency of the A. sydowi and P.
icans cultures. Methanol and water extractions
destroyed the water repellency of the heated
d cultures if the extractions were made before
heat treatments; however, if the extractions
e made after the sand cultures had been heated,
water repellency of the samples was not af-
ed. Wettable silica sand treated with the
hanol extracts of the sand cultures exhibited
er repellency when heated. Both the heat-in-
ed and natural water repellency of the soil was
affected by any of the solvent extractions, but
table sand treated with each of the extracts was
le water repellent by heat. A variety of known
inic substances was applied to wettable silica
d and the water repellency of the treated sand
rmined before and after heating. Amines were
only class of substances tested that caused
r repellency in sand before heating. A variety
substances, however, caused head-induced
r repellency in the sand. The heating condi-
s required to cause repellency were similar to
e required by fungal sand cultures and natural
er repellent soil. The primary conclusion of the
y was that heat-induced water repellency may
universal property of soils rather than property
ific to a limited number of soils. (Knapp-
S)
-08938

**L WATER EVAPORATION: SURFACE
IDUE RATE AND PLACEMENT EFFECTS,**
icultural Research Service, Mandan, N. Dak.
thern Plains Branch.
primary bibliographic entry see Field 02D.
-08953

**: MOVEMENT AND STORAGE OF WATER
ORTH CAROLINA SOILS AND THE ROLE
THE SOIL IN DETERMINING WATER
LITY,**
h Carolina Univ., Chapel Hill. Water
urces Research Inst.
lton Lutz.
er Resources Research Institute Report No. 24,
1969. 43 p. OWRR Project A-008-NC.

riptors: *Soil water movement, *Storage
city, *Soil physical properties, *Water quality,
lution (Soil), *Cation exchange, *Anion
ange, Porosity (Soil), Soil density, Soil water,
olation, Permeability, Leaching, Herbicides,
icides, Clay minerals.
tifiers: Available water, Bulk density, Weather-
Clay decomposition, Mineral losses.

e related but separate phases of work are re-
d. (1) Study of the physical properties of the
of North Carolina. Sixty-nine soil series
senting approximately two-thirds of the total
area of the State were sampled, and the fol-
g determinations made: Depth of the A and B
ons, bulk density, total porosity, hydraulic
luctivity, and the available, the unavailable,
the total water-holding capacities of the A and
rizons. The data should be valuable in planning water control (irrigation and drainage) in erosion control, in various phases of engineering, and in urban development (septic tanks and drainage). (2) Herbicide losses. Suspensions of kaolinite and montmorillonite were treated with two different rates of six herbicides and the amount of herbicide removed in increasing pressure increments determined, using the pressure membrane apparatus. Herbicides used were 2,4-D, simazine, atrazine, diuron, fluometuron, and CIPC. All herbicides, at both rates, were more readily lost from kaolinite than from montmorillonite. Simazine concentrations were greater in the higher pressure increments, but concentration of all others decreased as the pressure increased. (3) Cation and anion losses from clay minerals. Sodium and calcium montmorillonite were suspended in water and in the respective salts. Calcium kaolinite was suspended in water and in calcium chloride. Extracts were obtained at successively increasing pressures and the extracts analyzed for chloride, aluminum, and silicon. Essentially no aluminum was removed at any pressures, but silicon concentration ranged from 10 to 183 ppm. (Author)
W69-09028

2H. Lakes

RESOURCE SUBDIVISION AMONGST COHABITING FISH SPECIES IN A BAY, LAKE OPINICON, ONTARIO,
Queen's Univ., Kingston (Ontario).
Allen Keast.
Mich Univ, Great Lakes Res Div, Pub No 13, p 106-132, 1965. 5 fig, 15 tab, 21 ref.

Descriptors: *Fish, *Fish food organisms, *Food habits, Biomass, Bullheads, Pikes, Rock bass, Shiners, Silversides, Yellow perch.
Identifiers: Black crappie, Bluegill, Smallmouth bass.

The food habits of nine species of fish inhabiting a small bay of 800-hectare Lake Opinicon were determined. Fish were collected at three times during the day from May through September. Collections of plankton and bottom organisms were made in the same area. The diets of the fish species were analyzed by month, fish being grouped into size classes designed to elucidate differences in diet. Abundance of food organisms and number occurring in stomachs (all species of fish combined) were highly positively correlated for Cladocera, Amphipoda, Chironomidae (larvae and pupae) and Mollusca and highly negatively correlated for Copepoda. Cladocera and Chironomidae comprised the major food sources (by number) with Cladocera being utilized by all species of fish. Graphical and tabular data include stomach analyses by per cent volume, detailed diets of all fish species, and relative abundance and biomass estimates of all fish species. (Voightlander-Wis)
W69-08669

THE BOTTOM SEDIMENTS OF LAKE MONONA, A FRESH-WATER LAKE OF SOUTHERN WISCONSIN,
Wisconsin Univ., Madison.
W. H. Twenhofel.
J Sedimentary Petrology, Vol 7, No 2, p 67-77, Aug 1937. 3 fig, 1 tab, 4 ref.

Descriptors: *Bottom sediments, *Fresh water, *Lakes, Sludge, Mud, Marl, Calcium carbonate, Magnesium oxide, Iron, Aluminum, Lithification, Shale, Limestone, Wisconsin.
Identifiers: Organosilicon, Argillaceous limestone, Insoluble matter, Advent of white man, Lake Monona (Wis).

The bottom sediments of fresh water Lake Monona, Wisconsin, consist of a surface layer of black sludge high in organic matter and organosilicon, and a lower layer of firm, light-colored mud or marl. The sludge is composed of 30 to 45% calcium carbonate and 35 to 50% of insoluble residue. The marl contains from 50 to 70% calcium carbonate, 1 to 2% magnesium oxide, 15 to 25% of insoluble residue, and small amounts of iron and aluminum oxides. Lithification of the two layers would produce calcareous shale and siliceous-argillaceous limestone, respectively. The high content of insoluble matter in the sludge is correlated with occupation of the region by white man. (Wilde-Wis)
W69-08671

EUTROPHICATION OF INLAND WATERS.
Water Pollution Research Lab., Stevenage (England).
For primary bibliographic entry see Field 05C.
W69-08672

THE PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE SEDIMENTS OF LAKE MENDOTA, A FRESH WATER LAKE OF WISCONSIN,
Wisconsin Univ., Madison.
W. H. Twenhofel.
J Sedimentary Petrology, Vol 3, No 2, p 68-76, Aug 1933. 3 fig, 3 tab, 2 ref.

Descriptors: *Bottom sediments, *Fresh water, *Lakes, *Chemical analysis, Calcareous soils, Silica, Iron, Aluminum, Organic matter, Diatoms, Microorganisms, Mud, Wisconsin.
Identifiers: Holorganic oozes, Substratum, Lamination, Bedding, Fossil, Organisms, Lake Mendota, Wisconsin.

Sediments covering the bottom of fresh water Lake Mendota, Wisconsin, consist of two distinct layers: the surface layer of nearly holorganic black oozes harboring small, thread-like worms; the substratum of light gray calcareous sediments changing with depth to white marl. The latter fine-grained, mineral sediments are believed to extend to a depth of 35 feet beneath the present bottom. Their average composition includes 60 to 80% carbonate, largely that of calcium, 20% silica, and small amount of iron and aluminum oxides. The empoverishment of the substratum in organic matter is attributed to the activity of microorganisms. Careful search revealed no lamination or bedding of muds. Except for diatoms, marl is almost devoid of fossil organisms. The findings are applicable only to sediments formed in lakes of the same character and located in similar surroundings. (Wilde-Wis)
W69-08675

GEOLOGICAL CONDITIONS FOR THE FORMATION OF PEAT-BOGS OF THE CENTRAL PART OF WESTERN SIBERIA (RUSSIAN),
Moscow State Univ. (USSR). Dept. of Soil Science and Engineering Geology.
For primary bibliographic entry see Field 02G.
W69-08700

FLORIDA LAKES-PART 3, GAZETTEER.
Florida State Board of Conservation, Tallahassee. Div. of Water Resources.

Florida Board of Conserv, Div of Water Resources Rep, 1969. 145 p, 6 map, 2 ref, append.

Descriptors: *Lakes, *Florida, *Data collections, Surveys, Size, Surfaces, Altitude, Watersheds (Basins).
Identifiers: Florida Lakes Gazetteer.

Florida lakes of 10 acres or more are listed alphabetically and by drainage basins. Altitudes, surface areas, and drainage areas are tabulated. A state index map and 5 aerial maps show the principle drainage and the lakes. (Knapp-USGS)
W69-08753

A COASTAL POND STUDIED BY OCEANOGRAPHIC METHODS,
Woods Hole Oceanographic Institution, Mass.
K. O. Emery.

New York, American Elsevier Publ Co Inc, 1969. 80 p, 9 tab, 41 fig, 75 ref.

Descriptors: *Lakes, *Sediments, *Surface-groundwater relationships, *Life cycles, *Massachusetts, Hydrologic budget, Human population, Aquatid life, Water quality, Organic matter, Water temperature, Stable isotopes, Gases, Saline water, Oceans, Climates, Model studies.
Identifiers: *Oceanographic methods, Woods Hole (Mass), Cape Cod.

This monograph describes an inexpensive backyard model study using Oyster Pond, a coastal body of water on Cape Cod as the ocean. The study cuts through much of the whole field of oceanography; it is suggested that the widespread occurrence of such ponds in the United States and other countries useful environments for oceanographic education since many problems are common to both ocean and the ponds. The history of Oyster Pond is traced to 14,000 years ago; the climate, topography, geology, sediments, and water characteristics are well described. Since precipitation plus groundwater inflow from shoreline seeps and springs greatly exceed evaporation the pond normally overflows about 3,100 cu m per day to the ocean 98% of the time. Inflow of groundwater corresponds to 4 cu m per day per linear m of marine shoreline, a high rate of infiltration due to sandy, very permeable glacial till. Based upon sediment deposition the past 200 yr, Oyster Pond can remain a water body for 4,000 yr more if the sea level remains as now and man's activities do not materially alter the pond. (Lang-USGS)
W69-08922

WIND-DRIVEN CIRCULATION IN A TWO LAYER LAKE,
Wisconsin Univ., Madison.
J. A. Hoopes.
Paper presented at Seventh National Fall Meeting of American Geophysical Union, San Francisco, California, December 2-4, 1968. OWRR Project B-009-Wis.

Descriptors: *Interfaces, Limnology, Viscosity, Density, Stratifications, Free surfaces, Wind pressure.
Identifiers: *Steady state circulation model, Near shore boundary currents, Wind shear, Internal friction, Vertical motion.

A theoretical model of the steady-state circulation in a two-layer lake has been investigated. This model, which incorporates the effects of wind shear, internal friction, and vertical motion, is a solution to the linearized equations of motion (i.e., assuming small Rossby number). The eddy viscosity and density are assumed constant in each layer, and the shear, velocity, and pressure are assumed to be continuous across the interface between the layers. Applying the model to a circular lake of constant depth, analytical expressions have been obtained for the three-dimensional velocity distribution and for the shape of the free surface and the interface due to: (1) a steady, uniform wind stress; and (2) a steady, constant curl wind stress. The shape of the interface, as predicted by this model, is in agreement with some experimental observations made in a one-foot diameter, circular cylinder. These results tend to support Csanady's prediction of concentrated, near-shore boundary currents or 'coastal jets' in large lakes (see G. T. Csanady, 'Large-Scale Motion in the Great Lakes', J. Geophys. Res., 72, 4151-4162, 1967); however, Csanady's frictionless model of the circulation predicts more concentrated interfacial depth changes near shore than were observed in the model. (Author)
W69-09012

AN IMPROVED METHOD FOR EXTRACTION OF ORGANOCHLORINE AND ORGANOPHOSPHATE INSECTICIDES FROM LAKE WATERS,
Wisconsin Univ., Madison.
J. G. Konrad, H. B. Pionke, and G. Chesters.
Analyst, Vol 94, May 1969, p 490-492. OWRR Proj B-016-Wis.

Descriptors: *Separation techniques, *Organophosphorus pesticides, *Aldrin, *Dieldrin, *Endrin, Diazinon, Chromatography.
Identifiers: *Gamma-BHC, *Heptachlor epoxide, *Parathion-methyl, Parathion, Malathion.

The sensitivity of a benzene extraction method described previously for the extraction of organochlorine and organophosphate insecticides from lake waters has been increased from 20 to 200 times with little loss in accuracy or reproducibility. Average recoveries of gamma-BHC, aldrin, heptachlor epoxide, dieldrin, endrin, pp'-TDE, PP'-DDT, pp'-methoxychlor, phorate, parathion-methyl, diazinon, parathion and malathion ranged from 93.5 to 99.5 percent at concentrations of 0.062 to 1.165 micrograms per litre, the concentrations being chosen within this range to allow simultaneous gas-liquid chromatographic detection of a mixture of insecticides in a single extraction. Average recovery of heptachlor was 89.4 percent, presumably due to loss of heptachlor from the system by either degradation or volatilization. (Chesters-Wis)
W69-09016

FRACTIONATION OF INORGANIC PHOSPHORUS IN LAKE SEDIMENTS: I. RELEASE AND RESORPTION OF PHOSPHORUS DURING FRACTIONATION,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 05C.
W69-09019

FRACTIONATION OF INORGANIC PHOSPHORUS IN LAKE SEDIMENTS: II. FORMS AND AMOUNTS OF INORGANIC PHOSPHORUS,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 05C.
W69-09020

MEASUREMENT OF BIOLOGICAL N2 FIXATION,
Wisconsin Univ., Madison.
R. H. Burris.
Paper presented at Meeting of IBP on Microbial Production, Leningrad, May 27-31, 1969, 9 pages, 3 fig, 12 ref. OWRR Project B-020-Wis.

Descriptors: *Nitrogen fixation, *Lakes, Acetylene reduction, *Soils.
Identifiers: *Lakes, *Nitrogen fixing agents.

The N2 fixing enzyme system reduces not only N2 but also acetylene, azide, N20, cyanide, methyl isocyanide and certain analogues of these compounds. The reduction of acetylene serves as a sensitive index for the activity of the N2-fixing enzyme complex, because the ethylene produced from acetylene can be measured readily by gas chromatography. The method can be applied readily in the field with simple equipment. It has been used for studying N2 fixation in soils, by leguminous and non-leguminous root nodules, by blue-green algae from lakes and by purified enzyme preparations in the laboratory. The manuscript describes methods for sampling, exposure of samples to acetylene and analysis for ethylene production. The investigator should be sure to compare acetylene reduction with N2 reduction to establish a proper conversion factor to permit calculation of N2 fixation. (Author)
W69-09021

MODEL STUDIES AND NUMERICAL SOLUTIONS OF THE CIRCULATION IN LAKE SUPERIOR,
Wisconsin Univ., Madison.
J. A. Hoopes, S. L. Lien, and J. W. Mitchell.
Paper presented at 12th Conference on Great Lakes Research, Ann Arbor, Michigan, May 5-7, 1969. OWRR Project B-009-Wis.

Descriptors: *Lake Superior, *Numerical anal
Identifiers: *Wind-driven circulation, *Su
currents, Two-layer lake, Variable geometry.

The steady, wind-driven circulation in Lake Su
or has been investigated using a rotating, vert
distorted laboratory model and numerical solu
of the equations of fluid motion. The labor
model, which was designed on the basis of eq
of Froude and Rossby numbers between the n
and Lake Superior, was constructed with hor
tal and vertical length scale ratios of 1:300,00
1:1,000 respectively and is rotated at 4.86
Surface currents, generated by blowing air ove
model, are determined by measuring the disp
ments and directions of small floating par
photographically. In experiments with the m
surface currents and streamline patterns have
measured for both a homogeneous and a two-
lake, subject to uniform and constant curl,
stress distributions, though the patterns are
pronounced with the constant curl stress. Fo
homogeneous lake, the predominant feature o
circulation is a strong (up to 2 knots), narrow (
miles wide), counterclockwise current aroun
lake perimeter. For the two-layer lake, delta
phi=0.0005, these same current patterns are
served. In addition, the upper layer forms a na
band 1-10 miles wide around the lake perime
Numerical computations of the free surface an
terface displacements and the vertically integ
volume transports have been made using a
difference form of the steady-state, frictio
equations of motion. These solutions take int
count the variable geometry of Lake Superior
both horizontal and depth variations) and
been carried out for a homogeneous and a
layer lake. The results of these numerical com
tions are in agreement with the experimental o
vations in the laboratory model and with field
servations, principally along the southern sho
the lake. (Hoopes-Wis)
W69-09022

COASTAL CURRENTS IN STRATIFIED SE
Wisconsin Univ., Madison.
G. T. Csanady.
Paper presented at Midwest Geophysics Colle
um, Ann Arbor, Michigan, May 9-10, 1
OWRR Project B-009-Wis.

Descriptors: Stratification, Limnology, Great l
Lake Huron, Currents (Water), Coastal structu
Identifiers: Kelvin waves, Wave velocity, Co
jets.

The linearized equations of motion for a strat
liquid are shown to possess steady-state solu
similar in spatial structure to Kelvin wave
which the velocity amplitude decays exponen
with distance from a straight shore. A combin
of various different free modes of this kind
result in 'coastal jets' of fairly complex struc
Application of the results to idealized models o
Great Lakes suggests that stratification may in
be at least a contributory cause of the comple
of 'coastal jets' observed, for example, in Lak
ron. (Author)
W69-09026

2I. Water in Plants

**ALKALI SACATON SEEDLING SURVI
AND EARLY GROWTH UNDER TEMP
TURE AND MOISTURE STRESS,**
Forest Service (USDA), Albuquerque, N.
Rocky Mountain Forest and Range Experi
Station.
Earl F. Aldon.
Rocky Mountain Forest and Range Exper
Station, USDA Forest Service Res Note RM
1969 4 p, illus.

Descriptors: *Grasses, *Erosion, *Ranges, Er
control, Soil stabilization, New Mexico.

The optimum growing conditions for alkali sa
seedlings are 85 deg F and soil moisture at

acity. Five other temperatures and one other moisture level were tested for their effect on ot and root growth, shoot and root weight and lling survival. In another study alkali sacaton llings were subjected to 19 different watering edules representative of summer thundershower ditions. Survival was better after 5, 10, 15, and lays in those pots that were rewatered once. Al- sacaton plants seem to need rewatering after 5 10 days. If they received additional moisture ng this time, survival was much better (91 per- to 99 percent) than if these young plants were ed to go longer before another wetting (Sur- l dropped below 76 percent). (Author)
9-08643

THODS OF MEASURING AND ANALYZING INFALL INTERCEPTION BY GRASS,
est Service (USDA), Berkeley, Calif. Pacific thwest Forest and Range Experiment Station.
ert P. Crouse, Edward S. Corbett, and Donald Seegrist.
letin of the I.A.S.H., XI Annee No 2, p 110-120, 6

criptors: *Rainfall, *Interception, *Measure- nt, *Grasses, Instrumentation, Water loss, cipitation (Atmospheric), Canopy, Storms, rm structure, Plant growth, Waterproofing.
ntifiers: Interception storage capacity, Ground er, Plant height, Shower frequency.

tudies at San Dimas Experimental Forest, near ndora, California, the water storage capacity of sses was proportional to the product of average ght and percent of ground cover. The total inter- tion loss for a storm was a function of the age capacity and the number of showers per m. (Authors)
9-08656

INFALL INTERCEPTION BY ANNUAL ASS AND CHAPARRAL...LOSSES COM- RED,
est Service (USDA), Berkeley, Calif. Pacific thwest Forest and Range Experiment Station.
vard S. Corbett, and Robert P. Crouse.
Forest Serv Res Paper PSW-48, 1968. 12 p.

criptors: *Chaparral, *Grasses, *Interception, iinfall, Precipitation (Atmospheric), Measure- nt, Instrumentation, Water loss, Canopy, lching, Storms, Storm structure.
ntifiers: Litter.

s of precipitation due to interception by annual ss and grass litter was measured during three y seasons on the San Dimas Experimental est, in southern California. Interception loss n annual grass averaged 7.9 percent; that from ure chaparral cover, 12.8 percent. If chaparral ds were converted to grass, an estimated 1.3 es of gross interception could be saved each r. (Authors)
9-08662

ERNAL WATER STATUS OF PLANTS,
raska Univ., Lincoln. Water Resources earch Inst.
y D. Eastin, Charles Y. Sullivan, and E. J. bacher.
ject Completion Rept, July 1969. OWRR Pro- A-005-NEB.

criptors: *Water stress, *Photosynthesis, piration, Carboxylating enzyme.

ghum (Sorghum bicolor (L.) Moench) is a crop wn for its ability to persist under heat and sture stress and often to make productive nomic recovery once stresses are alleviated. mechanisms permitting sorghum and other nts to exist under water stress are not well un- stood and thus cannot be fully exploited. To n perspective in this area whole plant tosynthesis and respiration were estimated by monitoring CO2 exchange as water stress was increased. Also activity of the primary carboxylating enzyme was assayed as water stress increased. Carbon dioxide uptake in light remained comparatively high until leaf water potential approached 20 atmospheres at which time CO2 exchange was near the compensation point. Simultaneously leaf resistance increased from about 0.3 to 0.5 min/cm. A sharp increase in leaf resistance (about 2 min/cm) was noted near 25 atmospheres. Evolution of CO2 in darkness increased 2-3 fold over a normal turgid condition at about 20 atmospheres water potential. As stress increased (> 25 atmospheres) dark CO2 evolution was reduced to a rate comparable to the turgid condition. Dark CO2 uptake was noted but its significance is difficult to assess. Phosphoenolpyruvic carboxylase activity remained quite high as water stress increased. In view of this the rapidly increasing leaf resistances with increasing water stress suggest the limitation observed on photosynthesis is associated with stomatal closure rather than failure of the carboxylation enzyme. (Authors)
W69-08887

BLASTOCLADIA AND AQUALINDERELLA: FERMENTATIVE WATER MOLDS WITH HIGH CARBON DIOXIDE OPTIMA,
California Univ., Berkeley. Dept. of Botany.
A. A. Held, R. Emerson, M. S. Fuller, and F. H. Gleason.
Science, Vol 165, No 3894, p 706-709, Aug 15, 1969. 4 p, 2 fig, 2 tab, 18 ref.

Descriptors: *Plant physiology, *Plant growth, *Carbon dioxide, *Fermentation, Aquatic fungi, Anaerobic conditions, Aerobic conditions, Ecological distribution, Oxygen requirements, Temperature.
Identifiers: *Water molds, Blastocladia, Aqualinderella.

The suggested existence of a polyphyletic group of fermentative water molds adopted to anaerobic environments rich in carbon dioxide has been confirmed by studies described in this paper. The uniflagellate aquatic phycomycete Blastocladia ramosa apparently is a facultative anaerobe. Blastocladia pringsheimii requires oxygen traces. Growth of both species is little or no greater at normal atmospheric oxygen pressure than under 0.2% oxygen pressure, but the addition of 5 to 20% carbon dioxide enhances growth. The cells of both species lack typical cristate mitochondria and contain only traces of cytochrome. Blastocladia resembles the biflagellate Aqualinderella fermentans in adaptation to an environment poor in oxygen and rich in carbon dioxide. (Lang-USGS)
W69-08923

ON THE POSSIBILITY OF QUANTITATIVELY EXTENDING PRECIPITATION RECORDS BY MEANS OF DENDROCLIMATOLOGICAL ANALYSIS,
National Center for Atmospheric Research, Boulder, Colo.; and Arizona Univ., Tucson. Lab. of Tree-Ring Research.
For primary bibliographic entry see Field 02B.
W69-08929

2J. Erosion and Sedimentation

EMERGENCY MEASURES TO CONTROL EROSION AFTER A FIRE ON THE SAN DIMAS EXPERIMENTAL FOREST,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 04A.
W69-08652

SOIL SLIPPAGE INCREASED BY BRUSH CONVERSION,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 04A.
W69-08655

SEASONAL DEBRIS MOVEMENT FROM STEEP MOUNTAIN SLIDE SLOPES IN SOUTHERN CALIFORNIA,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 04A.
W69-08664

THE BOTTOM SEDIMENTS OF LAKE MONONA, A FRESH-WATER LAKE OF SOUTHERN WISCONSIN,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 02H.
W69-08671

THE PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE SEDIMENTS OF LAKE MENDOTA, A FRESH WATER LAKE OF WISCONSIN,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 02H.
W69-08675

A NEW 'SPHINCTER' CORER WITH A RECOILLESS PISTON,
SACLANT ASW Research Centre, La Spezia (Italy).
For primary bibliographic entry see Field 07B.
W69-08696

MIDDLE ATLANTIC CONTINENTAL SLOPE OF UNITED STATES: DEPOSITION AND EROSION,
Columbia Univ., Dobbs Ferry, N.Y. Hudson Labs.
Peter A. Rona.
Amer Ass Petrol Geol Bull, Vol 53, No 7, p 1453-1465, July 1969. 13 p, 11 fig, 33 ref.

Descriptors: *Sedimentation, *Erosion, *Continental shelf, *Continental slope, *United States, Marine geology, Sediments, Deposition (Sediments), Stratification, Sediment transport, Sedimentary structures, Groundwater movement, Springs, Aquifers.
Identifiers: Continental slope sediments, *Middle Atlantic shelf.

Continuous seismic reflection profiles across outer continental terrace (outer continental shelf and slope) show that directly off Cape Hatteras reflection interfaces (sedimentary strata) with low seaward inclination of about 1 deg underlie the continental shelf and terminate at the continental slope, which inclines about 9 deg. On traverses about 200 km north of Cape Hatteras, reflection interfaces (sedimentary strata) do not terminate but incline about 3 deg nearly parallel with the continental slope. On the continental slope about 100 km north of Cape Hatteras both relationships are present. The association of erosional and depositional features is consistent with a model of continental terrace development in which strata accumulate on the continental shelf by upbuilding and on the continental slope by outbuilding while basement subsides during seaward tilting. At the continental slope, strata are terminated primarily by erosional processes. Periodically, rotational slumping at the continental slope occurs, causing strata from the slope and outer shelf to shift to the continental rise and exposing shelf strata at the edge of the continental terrace. (Knapp-USGS)
W69-08699

FACTORS AFFECTING SETTLING OF SILT FROM SUSPENSION ALONG THE EDGE OF THE EASTERN WADDEN SEA (THE NETHERLANDS),
Ijsselmeerpolders Development Authority, Kampen (Netherlands). Dept. of Research.
C. Berger.
Eng Geol, Vol 2, No 5, p 341-349, Aug 1968. 9 p, 4 fig, 2 tab, 6 ref.

Descriptors: *Sedimentation, *Estuaries, *Ponds, Drainage, Tides, Currents (Water), Waves

(Water), Turbulence, Silts, Clays, Deposition (Sediments), Aggradation, Erosion, Sediment yield, Sediment control.
Identifiers: *Netherlands, *Wadden Sea, Polders, Ijsselmeer.

Rows of settling ponds were constructed parellel and perpendicular to the edge of Wadden Sea, in the Netherlands. An 11-year sampling program showed that silt deposition decreases toward the coast, clay content in the pond-drainage ditches increases toward the coast, and clay content in the polder fields increases toward the coast. (Knapp-USGS)
W69-08705

BED THICKNESS AND GRAIN SIZE: CROSS-BEDDING,
Illinois Univ., Urbana; and Indiana Univ., Bloomington.
Adrian E. Scheidegger, and Paul Edwin Potter.
Sedimentology, Vol 8, No 1, p 39-44, Feb 1967. 6 p, 1 fig, 7 ref, append.

Descriptors: *Sediments, *Bed load, *Deposition (Sediments), *Stratification, *Sedimentary structures, Settling velocity, Turbulence, Dunes, Particle size, Stratigraphy, Hydrogeology, Particle shape.
Identifiers: *Cross-bedding.

Qualitative and quantitative observations show a general positive correlation between grain size and thickness of cross-bedded units. Greater sand-wave height correlates with greater turbulence which permits more and coarser grains to be transported. A theory is developed which qualitatively explains these relationships. (Knapp-USGS)
W69-08711

A COMPUTER PROGRAM FOR GRAIN-SIZE DATA,
Geological Survey, Washington, D.C.; and Woods Hole Oceanographic Institution, Mass.
John Schlee, and Jacqueline Webster.
Sedimentology, Vol 8, No 1, p 45-53, Feb 1967. 9 p, 3 fig, 3 tab, 17 ref.

Descriptors: *Particle size, *Classification, *Computer programs, Data processing, Digital computers, Histograms, Sediments, Sedimentology.
Identifiers: Particle size analysis computer program.

The computer program for sedimentary particle size analysis, used by the Woods Hole Oceanographic Institution-United States Geological Survey Atlantic Continental Margin project, fits a continuous distribution to discrete data by the method of continuous parabolic interpolation. In a few samples, negative size values were computed in the tails of the distribution as a result of this interpolation. To eliminate this difficulty, an exponential interpolation was substituted whenever negative values occurred in the tails. From the interpolated size data, moment measures were then calculated to characterize the size curve. When interpolated values as well as original measurements were used, rather than original measurements alone, the moment measures more truly represent the characteristics of the size distribution. (Knapp-USGS)
W69-08712

THE PRESENTATION OF SUBJECTIVE SHAPE AND ROUNDNESS DATA,
City Univ., London (England).
I. J. Smalley.
Sedimentology, Vol 8, No 1, p 35-38, Feb 1967. 4 p, 1 fig, 5 ref.

Descriptors: *Sediments, *Particle shape, *Classification, Measurement, Dimensions, Estimating, Test procedures.
Identifiers: Particle shape calssification scheme, Zingg particle-shape classification.

If a modified version of the Zingg system is used particles can be subjectively classified into four shape classes. The roundness of a particle can be estimated by assessing the flat/convex/concave ratio and can then be represented as a point on a triangular net; this point can also indicate the Zingg class of the particle. This paper presents pertinent data and illustrates the results of a shape and roundness analysis carried out on a sample of 100 pebbles from Hythe (Kent) beach, England. (Knapp-USGS)
W69-08713

RIPPLE MARK INDICES AND THEIR USES,
Florida State Univ., Tallahassee. Dept. of Geology.
W. F. Tanner.
Sedimentology, Vol 9, No 2, p 89-104, Sept 1967. 16 p, 4 fig, 19 ref.

Descriptors: *Ripple marks, *Classification, *Sedimentary structures, Shape, Currents (Water), Waves (Water), Winds, Sand waves, Sedimentary petrology, Bed load, Dunes, Sediment transport, Shear, Turbulence.
Identifiers: Ripple-mark classification, Symmetry.

A sedimentary ripple-mark classification is presented to use in identifying sedimentary accumulation environments by measuring various aspects of ripple mark geometry. Current ripple marks are easily separated from wing, wave, and swash marks. Current ripple marks have different parallelism, symmetry, straightness, and continuity from the other types, because current marks are shaped primarily by unidirectional eddies while wind, wave, and swash marks are controlled largely by shear movement. The parameters defined for ripple identification are ripple index, ripple symmetry index, continuity index, bifurcation index, straightness index, and 2 parallelism indices. (Knapp-USGS)
W69-08714

SIMULATION OF RIVER CHANNEL DEFORMATIONS,
State Hydrological Inst., Leningrad (USSR).
K. I. Rossinskiy.
Soviet Hydrol: Selec Pap, Issue No 2, p 101-114, 1968. 14 p, 5 fig, 10 ref. Trans Trudy Gos Gidrol Inst, No 143, p 186-203, 1968.

Descriptors: *Model studies, *Hydraulic models, *Sediment transport, *Channel erosion, *Hydraulic similitude, Reynolds number, Froude number, Channel morphology.
Identifiers: USSR, Channel phenomena simulation.

The rules for simulating channel phenomena on erosible models are described, the difficulties involved are discussed, and ways of overcoming them are outlined. Channel processes cannot be reproduced exactly on soft models so that approximate simulation must be resorted to. Methods of approximate simulation depend on the specific problems to be solved. Several approaches to simulation in specific cases are described. Modeling of river channels requires hydraulic similarity of river regime, sediment movement, and channel deformation. To achieve hydraulic similarity, it is necessary to duplicate the Droude, Reynolds, Stroudal, and Euler numbers. It is practically impossible to satisfy the Froude and Reynolds conditions simultaneously. Reynolds numbers must be large enough so that, model phenomena be in the self-similarity region. (Knapp-USGS)
W69-08723

LONGITUDINAL PROFILE AND CONVEYANCE OF AN EROSIBLE RIVER CHANNEL,
State Hydrological Inst., Leningrad (USSR).
I. F. Karasev.
Soviet Hydrol: Selec Pap, Issue No 2, p 123-138, 1968. 16 p, 6 fig, 1 tab, 27 ref. Trans Trudy Gos Gidrol Inst, No 150, p 83-102, 1968.

Descriptors: *Alluvian channels, *Stage-dischar relations, *Channel erosion, *Sediment transpo Regime, Channel morphology, Streamflow, E sion, Deposition (Sediments), Roughness (Hydra lic).
Identifiers: *USSR, Channel conveyance capacit

Most of the hydrometric data on river regimes late to individual cross sections at gaging statio The basic information obtained consists of me sured water discharges. Computations of chan deformations, the conveying capacity of the ch nel, the plotting of curves of the free surfa require more than data on the hydraulic eleme at a single cross section; they require knowledge their variation along the stream. Because hydrau data are not readily interpreted to yield chan storage, determination of channel conveyan from the discharge curve is complicated. Bott deformation and the inconsistency of the slopes the free surface and of hydraulic resistances, a other factors that change the character of the re tionship between discharges and water levels, w be fully defined only by analysis of the chan process over a sufficiently long river reach. Calc lation of the dynamic structure of nonuniform flo is necessary for determination of channel capaci and for determination of the locations of the cro section and the base line for measurement of t free surface slope. (Knapp-USGS)
W69-08727

SEDIMENT DATA FOR CANADIAN RIVER 1966.
Department of Energy, Mines and Resources, O tawa (Ontario). Inland Waters Branch.

Inland Waters Br Water Survey of Canada Bas Data Rep, 1969. 157 p, 1 map.

Descriptors: *Sediment load, *Rivers, *Suspend load, *Data collections, Sediment discharge, Sed ment yield, Streamflow, Discharge (Water), Sed ment transport, Stream gages, Sampling.
Identifiers: *Canada, Sediment sampling.

Data on the quantity and character of stream-tran ported sediment in Canada for water year 1966 a tabulated for use as a basis for studies of river cha nel morphology, erosion, deposition, and wat resources. The sampling equipment used described. Each sampling station record includ location of station, drainage area, type of gag period of record, mean discharge, extremes discharge and sediment load, history of station, r marks on record quality, and tabulated month mean sediment load and daily suspended load dat Particle-size analyses are included in some record (Knapp-USGS)
W69-08746

SOIL TEXTURE PATTERNS IN THE ALLUV UM OF THE LOWER INDUS PLAINS,
Hunting Technical Services Ltd., Boreham Woo (England).
D. A. Holmes, and S. Western.
J Soil Sci, Vol 20, No 1, p 23-37, Mar 1969. 15 p fig, 3 tab, 7 ref.

Descriptors: *Soil classifications, *Soil textur *Alluvium, Flood plains, Soil types, Soil textur Soil properties, Geomorphology, Soil chemistr Deposition (Sediments).
Identifiers: *Indus plain, *Pakistan.

Soil texture was mapped in the immature alluv soils of the Lower Indus plain. A disadvantage soil texture as a mapping criterion in such soils the great complexity of their textural patterns. T geomorphological background of the Lower Ind plains is examined, and a classification of textu and textural profiles is defined. The mapping u proposed, the 'textural association', comprises certain range of textural profiles within a giv landform, related to each other by the modes deposition which established that landform. seems likely that the textural association could.

e detailed surveys, form the basis of a soil series ification. (KnappdUSGS)
)-08761

IMENTARY ENVIRONMENTS AND UN-NSOLIDATED CARBONATE SEDIMENTS THE FRINGING CORAL REEFS OF MAHE, CHELLES,
gow Univ. (Scotland). Dept. of Geology.
hael Samuel Lewis.
ine Geol, Vol 7, No 2, p 95-127, Apr 1969. 33 4 fig, 37 ref.

criptors: *Sedimentation, *Coral, *Reefs, lcium carbonate, Sedimentology, Marine nals, Provenance, Sediment transport, Deposi- (Sediments), Currents (Water), Waves ter), Particle size, Turbulence, Channels, ds.
tifiers: Seychelles Islands.

ensive fringing coral reefs occur around Mahe, largest island in the Seychelles Archipelago. eral sedimentary environments, which are best eloped on reefs exposed to the Southeast Mon- (the dominant wind), are associated with the s. These are the beach, rippled sand zone, ine grass bed, radial zone, algal ridge, reef e, reef slope, 'plateau', mangrove and former grove swamps, deltas, channels, and the fore- environment. Skeletal carbonate sands form a eer on the reef flats and are widespread in the -reef environment. Locally they pass into rtz sands. Current transportation is dominantly lward, with little material being carried from reef flats into the fore-reef and channel en- nments. It is often difficult to relate the grain- measures of the sediments to their environ- t of deposition. The turbulent conditions in the ch, algal ridge and reef edge environments are ected in the absence of fine material and the dispersion values of the associated sediments. ss bed samples have high dispersion values and relatively rich in fines trapped by the grasses. ial zone samples show much variation in grain- measures due to the diversity of the conditions leposition. The skewness in mangrove swamp ments is positive, indicating normal current osition. Sheltered fore-reef deposits tend to be in fines and to have positive skewness values to the quiet conditions, whereas fine material is nowed from windward fore-reef sediments. (K- p-USGS)
)-08766

)SION.
primary bibliographic entry see Field 06E.
)-08790

AIN-SIZE INDICES, CLASSIFICATION AND IRONMENT,
icultural Univ., Wageningen (Netherlands). t. of Regional Soil Science.
Doeglas.
mentology, Vol 10, No 2, p 83-100, Mar 1968. .12 fig, 1 tab, 11 ref.

criptors: *Sedimentology, *Particle size, *Clas- ation, *Statistical methods, Sedimentation, ls, Silts, Clays, Sediments, Provenance, Sedi- t transport.
tifiers: *Wentworth sediment classification.

ces based on Wentworth phi values are osed for textural classification of sediments. indices, and to a smaller degree the names, sorting and skewness based on integer phi s. The classification scheme gives a continuous from gravel to fine clay, and the indices can sed for distinction of river, marine, and loess sits. The addition of indices of the 1st and 99th entile, giving 5-digit indices, augments the pos- ties for a determination of the environment; deposits can be distinguished from beach and sediments and in more detail from shallow ne and coastal deposits. The indices can be handled by data-processing machines. (Knapp-USGS)
W69-08905

SOME HYDRAULIC PROPERTIES OF BIOCLASTIC CARBONATE GRAINS,
Calgary Univ. (Alberta). Dept. of Geology.
W. R. Maiklem.
Sedimentology, Vol 10, No 2, p 101-109, Mar 1968. 9 p, 4 fig, 11 ref.

Descriptors: *Sediments, *Settling velocity, *Sediment transport, *Carbonates, *Particle shape, Suspension, Tractive forces, Particle size, Carbonate rocks, Coral, Algae, Sands, Gravels.
Identifiers: Carbonate grains, Bioclastics.

A simple experiment demonstrates that shape and bulk density of bioclastic carbonate grains are important factors affecting the grain-size distribution of a clastic carbonate sediment deposited in water. Settling velocities of bioclastic carbonate grains divided into shape groups--blocks, rods, spheres, and plates--have been compared to calculated settling velocities of calcite and aragonite. It was found that calculated settling velocities are up to 4 times greater than actual velocities. Block-shaped grains (coral and coralline algae) show the least differences; calculated velocities are as much as half greater for fine to medium sand grains but the same for gravel. Plate shaped grains of the foraminifera Marginopora have the largest differences; calculated velocities are about twice greater for sand and about 4 times greater for pebbles. The differences in settling velocities can be accounted for by shape, bulk density, and settling motion. Settling motion, in turn, is related to shape. (Knapp-USGS)
W69-08906

EFFECTS OF SUSPENDED MATERIAL ON WATER QUALITY,
Kansas Univ., Lawrence. Dept. of Civil Engineering; and Kansas State Geological Survey, Lawrence.
For primary bibliographic entry see Field 02K.
W69-08915

RELATIONS BETWEEN SUSPENDED MATTER AND SALINITY IN ESTUARIES OF THE ATLANTIC SEABOARD, U.S.A.,
Geological Survey, Woods Hole, Mass.
For primary bibliographic entry see Field 02K.
W69-08916

A COASTAL POND STUDIED BY OCEANOGRAPHIC METHODS,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 02H.
W69-08922

ERRORS IN USING MODERN STREAM-LOAD DATA TO ESTIMATE NATURAL RATES OF DENUDATION,
Geological Survey, Woods Hole, Mass.
Robert H. Meade.
Geol Soc Amer Bull, Vol 80, p 1265-1274, July 1969. 10 p, 9 fig, 56 ref.

Descriptors: *Sediment load, *Erosion, Rivers, Cultivated lands, Sedimentation, Silting, Aggradation, Provenance, Sediment distribution, Sediment yield.
Identifiers: Potomac River, Eastern U.S., Denudation rates.

The practice of calculating natural rates of denudation from routinely collected data on the loads of suspended and dissolved matter in modern rivers is subject to several significant errors. The sources of these errors are demonstrated by examples from the Atlantic drainage of the United States, where their total effect has apparently doubled the natural rate of erosion. The largest error is caused by assuming that modern sediment loads in populated areas represent natural erosion, whereas in fact they mainly reflect the influence of man. Conversion of forests to croplands in the middle Atlantic states causes about a 10-fold increase in sediment yield. Coal mining, urbanization, and highway construction have added extra loads of sediment to the streams. Modern sediment loads in the Atlantic-draining rivers are probably 4 to 5 times greater than they would be if the area had remained undisturbed by man. Errors in calculating the chemical denudation are caused by atmospheric contributions to the dissolved loads of streams and by pollutants that are added directly to stream waters. About 1/4 of the salts in Atlantic-draining streams were contributed from the atmosphere, either as recycled sea salts or as pollutants and soil dust that originally became airborne as a result of the activities of man. Perhaps another 1/10 of the dissolved load consists of industrial and agricultural wastes or acid mine waters that have been added directly to the streams. (Knapp-USGS)
W69-08939

GLOSSARY OF TERMS USED IN FLUVIAL, DELTAIC, AND COASTAL MORPHOLOGY AND PROCESSES.
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.

Louisiana State Univ Coastal Studies Inst Tech Rep No 63, Dec 15, 1968. 97 p. Richard J. Russell, Editor. Task Order No NR388022 ONR. Project No Nonr 1575 (03)ONR.

Descriptors: *Geomorphology, *Coasts, *Streams, *Deltas, Sedimentation, Erosion, Land farming, Topography.
Identifiers: *Glossary.

A glossary of terms used in fluvial, deltaic and coastal morphology studies was compiled by the Coastal Studies Institute of Louisiana State University as a project of Office of Naval Research. (Knapp-USGS)
W69-08940

2K. Chemical Processes

A GREENHOUSE STUDY OF RELATIONS BETWEEN NUTRIENT MOVEMENT AND CONVERSION IN A SANDY SOIL AND THE NUTRITION OF SLASH PINE SEEDLINGS,
Forest Service (USDA), Olustee, Fla. Southeastern Forest Experiment Station; and Yale Univ., New Haven, Conn. School of Forestry.
George W. Bengtson, and Garth K. Voigt.
Proc Soil Sci Society of America, Vol 26, p 609-612, 1962. 3 tab, 14 ref, disc.

Descriptors: *Lysimeter, *Fertilizers, *Cycling nutrients, Leaching, Water treatment, Urea, Transpiration.
Identifiers: Slash pine, Potassium-calcium pyrophosphate, Ammonium nitrate, Potassium chloride, Loss of nutrients.

A greenhouse lysimeter study was made of the stability of different nitrogen-phosphorus-potassium fertilizers against their removal by leaching and the availability of nutrient elements to slash pine seedlings growing in Lakeland fine sand. Leachate analyses showed that nearly all ammonium nitrate and potassium chloride applied to surface soil in bare lysimeters were leached from the upper 12 inches within four weeks when water was applied at the rate of 4 inches per week. At the same watering rate, urea-formaldehyde and potassium calcium pyrophosphate showed substantially lower leaching losses. The growth of pine seedlings prevented or reduced leaching of nitrogen and potassium at watering levels of 1 and 2 inches per week, but at a watering rate of 4 inches per week, the seedlings were relatively ineffective in reducing nutrient losses. Fertilized seedlings transpired from 30 to 80% more water than the controls, yet their water use per gram of dry matter produced was 25 to 50% less than that of unfertilized seedlings. (Wilde-Wis)
W69-08676

CLATHRATE HYDRATES OF AIR IN ANTARCTIC ICE,
California Univ., San Diego, La Jolla. Dept. of Chemistry.
Stanley L. Miller.
Science, Vol 165, No 3892, p 489-490, Aug 1969. 2 p, 1 fig, 15 ref.

Descriptors: *Clathrates, *Ice, *Glaciers, *Antarctic, *Hydrate processes, Air, Hydrates, Oxygen, Nitrogen, Bubbles, Solubility.
Identifiers: Antarctic ice bubbles.

Measurements of the dissociation pressure of nitrogen hydrate and oxygen hydrate show that a clathrate hydrate of air should exist below about 800 meters in the Antarctic ice sheet. This accounts for the disappearance of gas bubbles at depths greater than 1200 m. The hydrate should exist from this depth to the bottom of the core and should constitute 0.06% of the ice. (Knapp-USGS)
W69-08695

THERMODYNAMICS OF HYDROTHERMAL SYSTEMS AT ELEVATED TEMPERATURES AND PRESSURES,
Northwestern Univ., Evanston, Ill. Dept. of Geology.
Harold C. Helgeson.
Amer J Sci, Vol 267, No 7, p 729-804, Summer 1969. 76 p, 21 fig, 14 tab, 162 ref.

Descriptors: *Water chemistry, *Aqueous solutions, *Chemical potential, *Chemical reactions, *Geochemistry, Mineralogy, Thermodynamics, Saline water systems, Thermodynamic behavior.
Identifiers: *Hydrothermal reactions, Hydrothermal ore deposits.

Chemical relations in hydrothermal systems can be described in terms of the thermodynamic properties of minerals, aqueous species, gases, and concentrated sodium chloride solutions. Sufficient thermodynamic data are available to permit calculation of equilibrium constants for a large number of hydrothermal reactions at high temperatures and pressures. Where these data are incomplete, the calculations involve entropy estimates, application of average heat capacities, and/or assumptions concerning the temperature dependence of thermodynamic variables and the relative importance of electrostatic and non-electrostatic interaction among the aqueous species in hydrothermal solutions. High temperature stoichiometric activity coefficients for individual ions can be calculated using deviation functions computed from osmotic coefficients for concentrated sodium chloride solutions. The results of such calculations, together with computed heat capacities, enthalpies, entropies, and equilibrium constants for many hydrothermal species and reactions at high temperatures are presented in tables and diagrams. The methods, assumptions, and equations employed in the calculations are summarized in general notation. The numerical information contained in the tables permits calculation of the solubilities of silicates, sulfides, carbonates, sulfates, and oxides in multicomponent hydrothermal solutions containing high concentrations of sodium chloride at elevated temperatures, and evaluation of the mass transfer accompanying irreversible reactions responsible for metasomatism and ore deposition in hydrothermal systems. (Knapp-USGS)
W69-08698

THE COURSE OF SELF-PURIFICATION PROCESS OF CANALIZED, HIGHLY POLLUTED RIVERS,
H. Manzack.
Water Res, Vol 2, No 1, p 3-4, Jan 1968. 2 p.

Descriptors: *Self-purification, *Channeling, *Stream pollution, *Water quality, Biochemical oxygen demand, Dissolved oxygen, Reaeration, Navigable river, Aerobic conditions, Anaerobic conditions, Weirs.
Identifiers: *Poland, *Odra River, Self-purification process.

A study to establish the capacity of self-purification in channeled and unchanneled sections of Odra River, Poland is described. Hydrographic, hydrometric, chemical and biological measurements in the river showed: (1) Ice cover reduced the biochemical processes; (2) The coefficient of oxygen utilization in polluted water was about half that from unpolluted water; (3) This coefficient decreased sharply during the navigable period; (4) The reaeration process was much lower in channeled sections of the river than in unchanneled sections; (5) The self purification capacity was relatively high in unchanneled sections, without ice; (6) The self purification coefficient decreased in polluted water during summer and autumn only in the areas with high initial BOD values. It is concluded that canalization of Odra River has positive and negative features, of which the weirs which increase the amount of dissolved oxygen is the most important. The channel has negative effects such as accumulation of bottom sediment, hydrogen sulphide and occurrence of oxygen defficiency. (Carstea-USGS)
W69-08703

DETERMINATION OF GOLD IN WATERS IN THE NANOGRAM RANGE BY ANION EXCHANGE AND ATOMIC ABSORPTION SPECTROPHOTOMETRY,
Geological Survey, Denver, Colo.
T. T. Chao.
Econ Geol, Vol 64, No 3, p 287-290, May 1969. 4 p, 4 fig, 1 tab, 7 ref.

Descriptors: *Water chemistry, *Analytical techniques, *Chemical analysis, *Trace elements, *Gold, Ion exchange, Spectrophotometry, Anion exchange.
Identifiers: Atomic absorption spectrophotometry

A method has been developed whereby nanogram amounts of gold in waters can be accurately determined. The development of the method involves determination of optimum conditions for the complete recovery of gold from water using an anion exchange resin column, quantitative elution of gold from the resin, and final measurement of gold by atomic absorption spectrophotometry following MIBK (methyl isobutyl ketone) extraction of gold from a nitric acid solution. (Knapp-USGS)
W69-08706

COMPOSITIONAL SIMILARITIES BETWEEN HOT MINERAL SPRINGS IN THE JORDAN AND SUEZ RIFT VALLEYS,
Israel Atomic Energy Commission, Rehovoth; and Weizmann Inst. of Science, Rehovoth (Israel).
Emanuel Mazor.
Nature, Vol 219, No 5153, p 477-478, Aug 3, 1968. 2 p, 2 fig, 7 ref.

Descriptors: *Hot springs, *Water chemistry, *Mineral water, Seawater, Mixing, Groundwater, Chemical reactions, Thermal water, Aqueous solutions, Geochemistry, Saline water systems.
Identifiers: *Israel, Dead Sea, Red Sea, Lake Tiberias, Tiberias hot spring, Hamman Farun hot spring.

The chemical composition of water from Hammam Farun hot spring in the Suez Rift Valley, Israel is almost identical to that of waters from Tiberias hot springs in the Jordan Rift Valley. Springs in the rift valleys have very similar waters although their source rocks and structural geology are not similar. It has been suggested that in the geological past, seawater flooded the rift valleys and infiltrated the tectonically shattered rocks, and reaction of the trapped seawater with host rocks and native groundwater produced the present spring water. Finding similar water in springs of another rift valley supports the suggestion. Experiments on sea water mixed with rock samples resulted in formation of waters similar to the spring waters, which are depleted in Mg and Na, and enriched in Ca, Sr, Li, Br, sulfate, and Ra, relative to seawater. (Knapp-USGS)
W69-08709

DILUTE SOLUTION REACTIONS OF NITRATE ION AS APPLIED TO WA RECLAMATION,
Robert A. Taft Sanitary Engineering Center, cinnati, Ohio. Cincinnati Water Research Lab.
For primary bibliographic entry see Field 05D.
W69-08715

MATHEMATICAL MODELS FOR THE DIS SION OF RADIONUCLIDES IN AQUA SYSTEMS,
Texas Univ., Austin. Environmental Health gineering Research Lab.
For primary bibliographic entry see Field 02E.
W69-08739

MEASUREMENTS OF BACKGROUND RA TION IN AQUATIC HABITATS IN ALASKA
Dartmouth Coll., Hanover, N. H. Dept of Bio cal Sciences; and Army Terrestrial Scie Center, N.H.
For primary bibliographic entry see Field 02E.
W69-08740

FORTRAN IV PROGRAM FOR SYNTH AND PLOTTING OF WATER-QUALITY DA
Geological Survey, St. Paul, Minn.; and Geolo Survey, Lawrence, Kans. Water Resources Div
For primary bibliographic entry see Field 07C.
W69-08749

SULPHATE REDUCTION IN WATERLOG SOILS,
Rothamsted Experimental Station, Harpe (England).
C. Bloomfield.
J Soil Sci, Vol 20, No 1, p 207-221, Mar 196 p, 8 fig, 3 tab, 35 ref.

Descriptors: *Saturated soils, *Sulfates, *W chemistry, *Biodegradation, *Sulfur bact Anaerobic bacteria, Sulfides, Hydrogen sulfide ganic matter.
Identifiers: Sulfate reduction, Desulfovibrio.

To study the factors that influence the relea free hydrogen sulfide, flooded soils were incub with plant material and either sodium sulphat elemental sulfur. Residual sulphate, FeS hydrogen sulfide were measured throughout reaction. Less free hydrogen sulfide was evo from a periodically waterlogged soil than fr well-drained soil comparable HCl- and dithio soluble Fe content. With a readily soluble synth iron oxide as the source Fe, a slight excess o over the sulfate-equivalent sufficed to prevent of hydrogen sulfide. The native organic matt the well-drained Rothamsted top-soil seeme have no effect in promoting loss of hydrogen fide, but the FeS: hydrogen sulfide ratio strongly influenced by the nature of the material used as the source of energy. With c sodium sulfate or S, considerably more hydrogen sulfide was evolved with lucerne with rice blade. With S, the pH of the incut mixtures was close to that of the nominally S system, whereas with sodium sulfate the mi became quite alkaline. More free hydrogen su was evolved under the more alkaline condition tained with sodium sulfate, which suggests tha the initial mobilization of Fe that governs the tribution of the reduced S, rather than the pH-l bility relations of FeS. An oxidized surface la very effective in retaining sulphur in the soil napp-USGS)
W69-08754

THE EFFECT OF THE CONCENTRATION MOVEMENT OF SOLUTIONS ON SWELLING, DISPERSION, AND MOVEM OF CLAY IN SALINE AND ALKALI SOILS.
Reading Univ. (England). Dept. of Soil Scienc
For primary bibliographic entry see Field 02G
W69-08755

HAVIOR OF ORGANIC CHEMICALS IN
E AQUATIC ENVIRONMENT. PART 2-
HAVIOR IN DILUTE SYSTEMS,
shington Univ., St. Louis, Mo. Environmental
Sanitation Engineering Lab.
primary bibliographic entry see Field 05C.
9-08767

ME LEGAL AND ECONOMIC IMPLICA-
NS OF SEA WATER INTRUSION--A CASE
DY OF GROUND WATER MANAGEMENT,
ifornia Univ., Davis. Dept. of Agricultural
nomics; and California Univ., Davis. Water
ources Center.
rles V. Moore, and J. Herbert Snyder.
ur Resources J, Vol 9, No 3, p 401-419, July
9. 19 p, 2 fig, 1 tab, 26 ref.

criptors: *Saline water intrusion, *Aquifers,
lifornia, *Legal aspects, *Economics, Saline
er systems, Artificial recharge, Pumping, Irriga-
water, Canals, Water rights, Water law, Social
cts, Property values, Water supply, Water
s
ntifiers: *Salinas Valley (Calif).

Salinas Valley, an intensively cultivated
stal valley about 130 mi south of San Francisco,
oted for its summer vegetable production. The
gation water supply necessary for intensive crop
duction comes from pumping an underground
n recharged by percolation from the Salinas
er which flows through the Valley. Degradation
groundwater quality by saltwater intrusion has
ed abandonment of wells near the coast. A
logical survey of Monterey Bay indicates the
sence of silt, sand, and gravel. A gravelly out-
p located in submarine canyon walls is probably
180-ft aquifer. When legal alternatives are
lyzed within both the framework of welfare
nomics and the legal setting of property rights,
threat of court action by the injured parties
ses a change away from the present status quo
ition to one with which the pumpers in the un-
taminated area would be better off if they con-
uted to the cost of a fresh water canal rather
n suffer the consequences and costs of having
courts adjudicate groundwater damages. The
regate profit level of the entire pressure area
uld be maximized under this solution. (Knapp-
GS)
9-08768

TER SALINITY PROBLEMS: APPROACHES
LEGAL AND ENGINEERING SOLUTIONS,
rdsley, Hufstedler and Kemble, Los Angeles,
if.; and Colorado River Board of California, Los
geles.
ton J. Gindler, and Myron B. Holburt.
ur Resources J, Vol 9, No 3, p 329-400, July
9. 71 p, 4 fig, 298 ref.

criptors: *Saline water intrusion, *Salinity,
line water systems, *Desalination, *Legal
ects, *Economics, Artificial recharge, Pumping,
ter rights, Water law, Social aspects, Property
es, Cost-benefit analysis, Arid lands.
ntifiers: Salinity control agencies.

nity problems in the arid Western U.S. and both
l and engineering approaches to their solutions
discussed for reference use by the legal profes-
. The determination of desirable salinity levels
uires consideration of complex legal, cost and
efit, and engineering factors. Costs should
gnize valid water rights. The California Water
n is used to illustrate economic, legal, and en-
ering evaluations of salinity effects, control,
treatment. The use of static, dynamic, and
arge salinity barriers to prevent saline water in-
ion is discussed. The organization of regional
ncies is necessary to administer most salinity
trol undertakings. (Knapp-USGS)
9-08769

INTERPRETATION OF THE RESULTS OF HYDROGEOCHEMICAL PROSPECTING (RUSSIAN),
For primary bibliographic entry see Field 02F.
W69-08771

CATIONS AND SILICA IN NATURAL WATERS: CONTROL BY SILICATE MINERALS,
Johns Hopkins Univ., Baltimore, Md.
Owen P. Bricker.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 110-119, 1968. 10 p, 9 fig, 2 tab, 7 ref.

Descriptors: *Water chemistry, *Streams, *Chemical reactions, *Equilibrium, Leaching, Solutes, Aqueous solutions, Weathering, Mineralogy, Silicates.
Identifiers: *Silicate-water equilibria.

Reactions of water and silicate minerals control the composition of natural groundwater and surface waters. Silicate-water systems react at measurable rates in the laboratory and the final water composition is determined by the solid phases present in the system. In the natural system investigated, a small wooded watershed near Baltimore, Md., the major portion of the dissolved load of the stream is derived from rock weathering. Carbon dioxide-charged rain reacts rapidly with the silicate minerals in the bedrock and soil, producing solids more aluminous than the original silicates; the solution is enriched in dissolved silica, cations and bicarbonate ion. Aluminum is conserved in the solid phase. Most of the dissolved silica in the stream is derived from the breakdown of oligoclase feldspar even though quartz is the major silica mineral in the rock. The reaction of water with silicates is so rapid that the waters remain in near-equilibrium with one or more solid phases at all times. In this watershed the rate of removal of material as dissolved load is about 5 times greater than the rate of mechanical removal. (Knapp-USGS)
W69-08914

EFFECTS OF SUSPENDED MATERIAL ON WATER QUALITY,
Kansas Univ., Lawrence. Dept. of Civil Engineering; and Kansas State Geological Survey, Lawrence.
Ernest E. Angino, and Walter J. O'Brien.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 120-128, 1968. 9 p, 5 fig, 17 ref.

Descriptors: *Suspended load, *Water quality, Water chemistry, Equilibrium, Aqueous solutions, Turbidity, Hardness (Water), Color, Odor, Taste, Photosynthesis, Aquatic life, Adsorption, Absorption, Sediments, Dissolved oxygen.
Identifiers: Suspended contaminants (Water).

Some of the effects of suspended load on stream water quality are summarized. The suspended material contributes to turbidity, hardness, alkalinity, water color, affects photosynthetic activity, and may be harmful to some organisms. In obstructing the penetration of light it induces a reduction in photosynthesis and indirectly causes a change in the oxygen content of the stream. The suspended load may act as substrate for bacteria, fungi, and other microorganisms as well as influence the concentration of certain compounds by sorption. Study of the suspended load of rivers draining the Cretaceous chalk terrain of Western Kansas showed that at certain times of the year a large part of the load is calcite. At other times considerable amounts of quartz, clays, and organic debris make up the river load. The calcite was a clearly identified component in transported sediments of the Kansas River as much as 150 mi east of the eastern limit of Cretaceous outcrops. Considering the solubility of calcite, any solution of the suspended calcite influences the Ca, Mg, pH, and bicarbonate values of these streams and thereby stream hardness. A relatively constant K and Mg content suggests a possible positive control by exchange reactions with the clayload of the streams. Similar affects on the nitrate, phosphate, and possibly sulfate concentration are to be expected from seasonal changes in the organic content of streams. Presently we know few of the detailed mechanisms by which suspended material has any effect on the water quality of the water carrying it. (Knapp-USGS)
W69-08915

RELATIONS BETWEEN SUSPENDED MATTER AND SALINITY IN ESTUARIES OF THE ATLANTIC SEABOARD, U.S.A.,
Geological Survey, Woods Hole, Mass.
Robert H. Meade.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 96-109, 1968. 14 p, 10 fig, 2 tab, 34 ref.

Descriptors: *Suspended load, *Salinity, *Estuaries, *Atlantic coastal plain, Delaware River, Silts, Clays, Saline water-freshwater interfaces, Chemical precipitation, Flocculation, Water chemistry, Turbulence, Currents (Water), Tides.
Identifiers: Potomac River, Chesapeake Bay.

Despite the suggestion by laboratory experiments that suspended matter in rivers is flocculated and deposited where it reaches saltwater, the concentrations of suspended matter in estuaries associated with some moderately large rivers of the Atlantic seaboard show no accelerated decrease that can be attributed to salt flocculation. Velocities of the estuarine waters are apparently sufficient to obscure the expected effects of salinity and keep the material in suspension. The general decrease in suspended matter associated with increasing salinity in the seaward direction can be attributed to the simple dilution of river suspensions by seawater. Superimposed on the general seaward decrease in suspended concentration is a maximum concentration near the upstream limit of sea salt. Suspended concentrations decrease both upstream and downstream of the maximum. This maximum has been found at one time or another in all the estuaries that have been sufficiently studied. It seems to reflect the accumulation of suspended matter near the salt limit by net landward flow along the estuary bottom. (Knapp-USGS)
W69-08916

GRAPHICAL METHODS FOR STUDY OF DISSOLVED ALUMINUM COMPLEXES,
Geological Survey, Washington, D.C.
John D. Hem.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 15-23, 1968. 9 p, 5 fig, 9 ref.

Descriptors: *Water chemistry, *Aluminum, *Ions, Fluorides, Sulfates, Chemical potential, Chemical reactions, Geochemistry, Hydrogen ion concentration, Aqueous solutions.
Identifiers: Aluminum ions.

The distribution of ionic species in dilute solutions at 25 deg C and 1 atmosphere pressure can be computed by mathematical procedures based on the law of mass action and related thermodynamic equations. The computations require some knowledge of concentrations of ions and the forms of complexes or ion-pairs, and their stability constants, or their free energies of formation. Sufficient information is now available to permit accurate computations of the amount and form of dissolved species of many constituents of natural water. Graphs can be prepared which give relatively simple and direct insights into the details of natural water chemistry. Examples show the solubility of aluminum in relation to pH, the dominant dissolved forms of aluminum in solutions containing various concentrations of fluoride, and the propor-

tions of uncomplexed to total dissolved aluminum in such solutions. Graphs also are given showing the interrelated complexing effects of fluoride and sulfate and fluoride and hydroxide. (Knapp-USGS)
W69-08917

RESEARCH ON GROUND-WATER CONTAMINATED BY DEPOSITS OF SOLID WASTE,
Hessiches Landesamt fuer Bodenforschung, Wiesbaden (West Germany).
For primary bibliographic entry see Field 05B.
W69-08918

SOME QUESTIONS CONCERNING GEOCHEMICAL HYDRODYNAMICS,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
N. N. Verigin, and B. S. Sherzhukov.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 42-53, 1968. 12 p, 28 ref.

Descriptors: *Water chemistry, *Diffusion, *Dispersion, *Groundwater movement, Ion exchange, Mass transfer, Convection, Flow, Mixing, Density, Ion transport, Osmosis, Soil moisture, Soil water.
Identifiers: Geochemical hydrodynamics.

The migration and diffusion of solutes in moving groundwater and the mass transfer of ions between groundwater and rock minerals are discussed. Diffusion and sorption equations are derived theoretically and their solutions are compared with the results of field observations. Equations are given for 2-dimensional convective diffusion, sorption, flow of miscible fluids, solution at surfaces, and ion exchange. (Knapp-USGS)
W69-08919

DISSOLVED MATTER DISCHARGE AND MECHANICAL AND CHEMICAL EROSION,
Gidrometeorologicheskii Institut, Leningrad (USSR).
O. A. Alekin, and L. V. Brazhnikova.
Symp Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 35-41, 1968. 8 p, 4 tab, 10 ref.

Descriptors: *Dissolved solids, *Salts, *Water chemistry, *Weathering, Aqueous solutions, Solutes, Sediment load, Geochemistry.
Identifiers: *USSR, Chemical weathering.

The total quantity of salts discharged from rivers of the USSR is computed and compared to the total world discharge of salts. From the composition and amount of salt discharge, the amount of weathering is calculated. The world's yearly discharge of sediments is estimated to be 19,700 million tons, and of dissolved solids, 2,500 million tons. Calculated dissolved loads of river basins of the USSR and continental totals for the rest of the world are tabulated. (Knapp-USGS)
W69-08920

WATER ANALYSIS,
Geological Survey, Denver, Colo.
M. J. Fishman, and B. P. Robinson.
Anal Chem Annu Rev, Vol 41, No 5, p 323R-360R, Apr 1969. 38 p, 664 ref.

Descriptors: *Reviews, *Bibliographies, *Water analysis, *Chemical analysis, Solutes, Ions, Pesticides, Dissolved oxygen, Detergents, Organic matter, Radioisotopes, Stable isotopes, Trace elements.
Identifiers: Dissolved gases, Water analysis review.

Literature on water chemical analysis published between October 1966 and September 1968 is reviewed. The review includes a list of other reviews made in the period covered. Water analysis is subdivided into classes of constituents analyzed, and includes pesticides, oxygen, gases, detergents, organics, radioisotopes, and stable isotopes as well as common and trace ionic solutes. A bibliography of 664 entries is divided into the same classes as the text, and the entries in each class are alphabetically listed by author's name. (Knapp-USGS)
W69-08942

QUALITY OF SURFACE WATERS FOR IRRIGATION IN WESTERN STATES -- 1965.
Geological Survey, Washington, D.C.

Geol Surv Water-Supply Pap 1967, 1969. 148 p, 2 fig, 1 plate, 13 ref.

Descriptors: *Water quality, *Irrigation water, *Data collections, Water analysis, Surface waters, Salinity, Salt balance, Water chemistry, Water resources.
Identifiers: Irrigation water quality, Western U.S.

Water chemical quality data from 72 irrigation network stations west of the Mississippi River are presented. Each record includes location, a list of available records, extremes, runoff, silica, Ca, Mg, Na, K, bicarbonate, carbonate, sulfate, Cl, F, nitrate, B, total solids, %Na, SAR, specific conductance, and pH. (Knapp-USGS)
W69-08956

THE EFFECT OF CATION-EXCHANGE CAPACITY ON THE RETENTION OF DIQUAT AND PARAQUAT BY THREE-LAYER TYPE CLAY MINERALS: 2. PLANT AVAILABILITY OF PARAQUAT,
North Carolina Agricultural Experiment Station, Raleigh.
For primary bibliographic entry see Field 05B.
W69-08957

ADSORPTION AND DESORPTION OF INORGANIC PHOSPHORUS BY LAKE SEDIMENTS IN A 0.1 MOLAR SODIUM CHLORIDE SYSTEM,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 05C.
W69-09014

2L. Estuaries

ON THE REFLEXION OF WAVE CHARACTERISTICS FROM ROUGH SURFACES,
Oregon State Univ., Corvallis.
For primary bibliographic entry see Field 08B.
W69-08717

RICE HOPE PLANTATION V SOUTH CAROLINA PUBLIC SERV AUTHORITY (DAMAGE FROM SALT WATER INFILTRATION AS A TAKING).
For primary bibliographic entry see Field 06E.
W69-08776

RELATIONS BETWEEN SUSPENDED MATTER AND SALINITY IN ESTUARIES OF THE ATLANTIC SEABOARD, U.S.A.,
Geological Survey, Woods Hole, Mass.
For primary bibliographic entry see Field 02K.
W69-08916

GLOSSARY OF TERMS USED IN FLUVIAL, DELTAIC, AND COASTAL MORPHOLOGY AND PROCESSES.
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 02J.
W69-08940

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

A REVIEW OF DESALINATION PROC AND PRODUCT WATER COSTS,
Office of Saline Water, Washington, D.C.
W. F. Savage.
Pap, Fiftieth Annu Meet Amer Geophys Apr 1969. 18 p, 7 fig.

Descriptors: *Desalination, *Desali processes, *Water costs, Brackish water, water, Brine disposal, Runoff, Technology, treatment, Economics, Water reuse, Water q Distillation, *Water requirements, Mem processes, Reverse osmosis, Electrod Crystallization.
Identifiers: Salt removal, Water quantities.

Reviewing water requirements of the US t the first 20 yr of the next century show withdrawal uses in the 48 contiguous states ceed the mean annual natural runoff. Four m of supplying future water needs are: (1) con ing dams and aqueducts for diverting strea rivers to areas of greatest need, (2) weather m cation for increasing natural runoff, (3) waste water, and (4) desalting ocean or br water. Desalination is reviewed, with emph processes presently in use, plant sizes, and c water produced by each process. The tech for large plants is available, but additional re and development must be conducted for ob the projected decreases in product water co achieving widespread acceptance of desalti major means of solving our water problems economical basis. Seawater desalting costs range of plant sizes are represented graph (USBR)
W69-08866

NEED FOR SALINE GROUNDWATER TO ADVANCE DESALTING TECHNOLOG
Office of Saline Water, Washington, D. C.
W. W. Rinne.
Pap, Fiftieth Annu Meet Amer Geophys Apr 1969. 14 p, 1 fig, 3 tab, 10 ref.

Descriptors: *Demineralization, Desali plants, Water resources, Water quality, disposal, Pre-treatment (Water), Water trea Chemical properties, Water sources, Arid lan jection wells, Water costs, Brackish *Groundwater geology, Aquifer characte Economics, Sludge disposal, Saline water.
Identifiers: *Water quantities, *Groun quality, *Groundwater hydrology, Groun sources, Evaporation reservoirs.

A lack of specific information exists on saline aquifers in the water-short areas of the U S. F advances in desalting technology for br water applications emphasize the need for d the chemical composition and availability of ground-water supplies. The desalting proces used at a given location will be determined quality and quantity of available brackish w Waste brine disposal is one of the more problems in the desalting process develo Solar evaporation ponds and deep-well inj are the preferred disposal methods at inland tions. Although evaporation ponds are a goo gap method, deep-well injection provides a method for ultimate waste brine disposal. S deep-well injection prove successful, more da be needed on geological and hydrological fe of subsurface formations. Consideration m given to the complete desalting plant syste relation to intake and brine disposal facili achieving optimum system economics. (USB
W69-08867

MPARATIVE COST EVALUATION OF SALTED WATER SUPPLY VERSUS ALTER-TIVE FRESH WATER SUPPLY FROM A NVENTIONAL SOURCE,
as Water Development Board, Austin.
nald E. Morris.
, Fiftieth Annu Meet Amer Geophys Union, 1969. 20 p, 5 fig, 5 ref.

criptors: *Demineralization, Desalination nts, Water resources, *Cost comparisons, ater supply systems, Water quality, Water wells, elines, Pumping plants, Pre-treatment (Water), ne disposal, Water treatment, Economic justifi-on, Chemical properties, Water sources, Main-ance, Amortization, Capital costs, Operating s.
ntifiers: Water quantities, *Texas Water elopment Board, Texas Water Plan.

osting procedure was developed during desalt-studies in Texas, for comparing the cost of a er supply produced by saline water conversion inst the cost of providing a fresh water supply n a conventional source. For desalting, the ele-nts included in the costing procedure were: (1) l fields for saline feedwater supply; (2) an in-e system and pumping station; (3) pipelines; (4) treatment for saline water; (5) a desalting plant; (6) brine disposal. For a conventional water ply system, the elements of cost included: (1) water cost; (2) a well field or intake system; pipelines and pumping stations; and (4) a con-tional water treatment plant. The final nomic justification of a desalting project may ude: chemical quality comparisons, secondary efits, and projected life comparisons with future ilability of alternative supplies. The Texas ter Development Board considers desalting a practical solution to the interim water supply blems that exist in many areas of the state. BR)
9-08868

. Water Yield Improvement

IMATING PROBABILITIES OF RESEARCH CCESS IN THE ATMOSPHERIC SCIENCES: SULTS OF A PILOT INVESTIGATION,
ional Center for Atmospheric Research, lder, Colo.; Clark Univ., Worcester, Mass.; and toria Univ. (British Columbia).
l R. Julian, Robert W. Kates, and W. R. Derrick ell.
ter Resources Research, Vol 5, No 1, Feb 1969. 5-227, 2 fig, 6 tab, 14 ref.

criptors: Projects, *Weather modification, hnology, Probability.
ntifiers: *Research and payoff model, *Evalua-of alternatives, Research success.

paper has two objectives. First, it outlines a arch and payoff (R and P) model that suggests ocedure for evaluating competing or concur-research projects. Weather modification has n touted as an answer to many water resource blems. Alternatives have received little atten-. Second, the paper makes a pilot study to rmine the estimated probabilities of success of ous technologies in the atmospheric sciences. A stionnaire was sent to professional atmospheric ntists to determine whether (a) scientists are ng to provide probability estimates of success arious technologies and whether these esti-es are consistent with other estimates of suc-; (b) personal involvement in a field influences estimates; (c) the probability estimates are sistent with the respondents' assignment of es in a research budget; and (d) the estimates e with reports of 'blue-ribbon' panels of ex-s. It is concluded that reasonably consistent nates of research success are obtainable. The ee of optimism among those sampled is high; it ghest for those workers involved in and having gh degree of knowledge of a particular field. tinued efforts in the determination of research ess probabilities are recommended. (Gossen-ago)
9-08633

SNOW ACCUMULATION AND DISAPPEARANCE BY ASPECT AND VEGETATION TYPE IN THE SANTA FE BASIN, NEW MEXICO,
Forest Service (USDA), Albuquerque, N. Mex. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 02C.
W69-08645

SOIL-MOISTURE TRENDS AFTER THINNING AND CLEARCUTTING IN A SECOND-GROWTH PONDEROSA PINE STAND IN THE BLACK HILLS,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 02G.
W69-08647

WATERSHEDS ASSUME IMPORTANT ROLE IN FOREST MANAGEMENT IN HAWAII,
Forest Service (USDA), Honolulu, Hawaii. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 04D.
W69-08650

IN HAWAIIAN WILDLANDS WATER BECOMES THE MOST IMPORTANT FOREST CROP,
Forest Service (USDA), Honolulu, Hawaii. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 04D.
W69-08651

RAINFALL INTERCEPTION BY ANNUAL GRASS AND CHAPARRAL...LOSSES COMPARED,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 02I.
W69-08662

SELECTIVE CONTROL OF BRUSH ON CHAPARRAL WATERSHEDS WITH SOIL-APPLIED FENURON AND PICLORAM,
Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
Edwin A. Davis, and Charles P. Pase.
USDA Forest Serv Res Note RM-140, 1969. 4 p.

Descriptors: *Herbicides, *Chaparral, *Brush control, *Water yield improvement, Forest management, Watershed management, Pesticides, Agricultural chemicals, Chemicals, Urea pesticides, Wildlife management, Habitat improvement, Soil treatment, Brush.
Identifiers: *Fenuron, *Picloram.

Pelleted fenuron and picloram were applied by hand as spot treatments to increase water yield. Desirable browse species for big game can be retained by this method. Picloram, at half the application rate of fenuron, was less toxic than fenuron to the oaks, but more toxic to the other shrubs. Season of application, particularly as it relates to precipitation pattern is important in the performance of soil-applied herbicides in Arizona. Two natural products of chaparral watersheds are water and big game. To achieve a maximized balanced output of these products it is proposed that a nonselective brush eradication treatment be followed by grass and browse establishment programs. This approach would allow the establishment of specific browse shrubs in desired densities for a maximized balanced output of water and game. (Authors)
W69-08663

INCREASING WATER YIELD FROM FOREST, CHAPARRAL, AND DESERT SHRUB IN ARIZONA,
C. P. Pase, and Martin M. Fogel.
Int Conf on Water for Peace Proc, Vol 2, p 753-764, 1967. 12 p, 6 fig, 5 ref. For 8-volume proceedings see Vol 2, No 9, 06B, W69-03305.

Descriptors: *Arid lands, *Watershed management, Arizona, Demonstration watersheds, Runoff, Small watersheds, Caliche, Hand pan, Evaporation control, Evapotranspiration control, Soil-water plant relationships, Water yield improvement, Cutting management, Flow augmentation, Chaparral, Grasslands, Coniferous forests, Deserts.
Identifiers: *Vegetation manipulation, Sodium chloride.

Increasing human water needs in arid lands have stimulated research on vegetation and soil surface manipulation to decrease evapotranspiration and soil surface evaporation. Extent and composition of forest, chaparral and desert shrub in Arizona are outlined. A commercial timber harvest, 45% basal area, did not significantly increase water yield; but, conversion of moist-site mixed conifers to grass increased stream flow 8.4 cm/yr. Previously burned dense chaparral increased water yields 8 to 25 cm/yr after conversion to grassland. Supression of shrubs with annual (4) aerial application of 2,4,5-T permitted development of herbaceous cover. An increase of 1.2 cm of surface runoff was obtained in desert shrub vegetation areas with the application of sodium chloride to alter infiltration characteristics of the surface soil. Runoff water was of excellent quality for agricultural use. (Sherbrooke-Ariz)
W69-08685

3C. Use of Water of Impaired Quality

TOWARD FULL WATER UTILIZATION IN SAUDI ARABIA,
H. E. Hassan Mishari.
Int CONF on Water for Peace, Vol 2, p 832-841, 1967-68. 10 p, 2 fig. For 8-volume proceedings see Vol 2, No 9, 06B, W69-03305.

Descriptors: *Water resources development, *Water resources planning, *Groundwater, Deserts, Aquifer characteristics, Deep wells, Irrigation programs, Saline water, Desalination, Water utilization efficiency.
Identifiers: Saudi Arabia.

This is a review of water problems and governmental interest in water development in a desert kingdom. A general hydrogeological sketch includes discussion of 'fossil' water, geologic down-dip, and coastal brackish underground waters. Saudi experts and teams of experienced international experts and consultants are employed in the evaluation of the groundwater resources. The major methods of investigation are costly drilling and aquifer testing. AQUIFER COEFFICIENTS OF STORAGE AND TRANSMISSIBILITY WILL BE CALCULATED. Chemical composition, recharge, and isopiezometric surface of the different aquifers will be studied. Potentialities of subsurface dams and infiltration galleries are being investigated. A discussion is presented of water development projects in progress, which include land reclamation, irrigation, drilling, flood control, municipal and stock water supplies and desalination. Water costs are considered in relation to use. (Sherbrooke-Ariz)
W69-08687

PRACTICAL APPLICATION OF FOAM FRACTIONATION TREATMENT OF LOW QUALITY WATER,
Alaska Univ., College. Inst. of Water Resources.
R. Sage Murphy.
Completion Report to Office of Water Resources Research, Department of the Interior, Washington, DC, August 1969. 11 p. OWRR Proj No A-024-ALAS.

Descriptors: *Foam fractionation, *Flotation, *Deferrization.

A foaming technique, using ethylhexadecyldimethylammonium-bromide, bubble aeration, no reflux or recycle, and ground waters was tested for iron removal efficiencies. The intent of the project

was to utilize local materials and labor, as found in remote Alaskan areas, for the construction of the batch treatment process. Although previous laboratory studies indicated the process was satisfactory, field tests were unsatisfactory and further development is deemed unwarranted. Some function of water temperature is believed to have inhibited the reaction. Since close temperature control would be uneconomical for the purpose intended for the unit, the attempt to sophisticate the system was abandoned. The best results obtained in the prototype unit removed 61.9 percent of the iron, leaving a residual of 7.8 mg/l, 20 times the minimum USPHS standard. Most runs achieved, on the average, 11.15 percent iron removal, equivalent to a residual of 23.54 mg/l Fe++. (Author)
W69-08690

SOME ASPECTS OF WATER SUPPLY AND SEWERAGE IN ROMANIA (ROMANIAN),
State Water Committee, Bucharest (Rumania).
For primary bibliographic entry see Field 05D.
W69-08962

3F. Conservation in Agriculture

NUCLEAR ENERGY AND THE AGRO-INDUSTRIAL COMPLEX,
Oak Ridge National Lab., Tenn.
Alvin M. Weinberg.
Nature, Vol 222, No 5188, p 17-21, Apr 1969. 5 p, 3 fig, 2 tab, 4 ref.

Descriptors: *Nuclear energy, *Agriculture, Industries, Wheat, Crops, Nuclear engineering, Desalination, Demineralization, Water costs, *Crop production, Charts, Grains (Crops), *Electric power, Powerplants, *Agronomy, *Nuclear powerplants, Experimental farms, Professional personnel, Demonstration farms.
Identifiers: Breeder reactors, Israel, Great Britain, *Nuclear power, Tables (Data), Nuclear desalination devices.

Scientists at the Oak Ridge National Laboratory, Tenn, believe that a nuclear-powered agro-industrial complex could be an instrument for social and economic improvement in underdeveloped countries and a means for providing more food for the world's growing population. This complex would consist of an integrated collection of heavy chemical industries clustered around large reactors and desalting plants, and associated with a highly mechanized, scientific farm. The farm would essentially be a food factory. Initial studies are underway to locate such complexes in the Gujarat Peninsula in India and the southeastern rim of the Mediterranean. Israel has plans for 2 experimental farms in Negev where scientific agriculture, based on using distilled water for irrigation, is to be conducted. Tables and charts showing costs of distilled water, crop water-yield relationships, and cost details and sensitivity of agro-industrial complexes are given. (USBR)
W69-08840

COST OF PUMPING IRRIGATION WATER IN TEN NEW MEXICO COUNTIES,
New Mexico State Univ., University Park. Dept. of Agricultural Economics.
Roger B. Long.
Agricultural Experiment Station, New Mexico State University, Bulletin 490, March 1965. 43 p, 13 fig, 29 tab, 1 append, 4 ref.

Descriptors: *Pumping, *Irrigation, *Average costs, Water yield.
Identifiers: *New Mexico.

This study determined the average costs of pumping irrigation water. Also, the relation of these costs to pump yield was studied. Data were obtained through personal interviews with farmers. The average costs per acre-foot of water pumped in ten counties were reported. A description of the crops, physical irrigation characteristics, and costs of each county studied were included. In the conclusion pump costs are related to pump yields so that farmers can tell how their costs will change when they increase or decrease their pump yields. (Grossman-Rutgers)
W69-08963

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

MAYNARD V HAWLEY (SUIT TO ENJOIN DRAINAGE OF WATER UPON LAND).

331 Mich 123, 49 NW2d 92-95 (1951).

Descriptors: *Michigan, *Surface drainage, *Road construction, *Surface runoff, Drainage engineering, Drainage, Ditches, Culverts, Channels, Surface water, Highways, Roads, Swamps, Rain water, Ponds, Flooding, Legal aspects, Judicial decisions.
Identifiers: Injunction.

A newly constructed highway separated plaintiff's land from the higher land of the defendant. Suit was brought to enjoin defendants' (private landowner and county road commission) drainage of water from higher property onto plaintiff's land. The court first noticed that the highway commissioners had the right to drain surface water, falling or naturally coming upon the highway, through natural and usual channels upon and over lower lands. Drains could be constructed for such purpose. The court held that the evidence sustained the finding that the ditches and culverts did not increase the amount of water flowing upon the land involved, but rather such land received substantially the same amount of surface water which it had received for years past. The court affirmed the findings for defendants. (Logan-Fla)
W69-08634

ALKALI SACATON SEEDLING SURVIVAL AND EARLY GROWTH UNDER TEMPERATURE AND MOISTURE STRESS,
Forest Service (USDA), Albuquerque, N. Mex. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 02I.
W69-08643

EMERGENCY MEASURES TO CONTROL EROSION AFTER A FIRE ON THE SAN DIMAS EXPERIMENTAL FOREST,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
R. M. Rice, R. P. Crouse, and E. S. Corbett.
US Dept Agr Misc Publ 970, p 122-130, 1965.

Descriptors: *Erosion control, *Check structures, *Demonstration watersheds, *Contour furrows, *Grasses, Soil erosion, Burning, Overland flow, Slope stability, Terracing, Barley, Watershed management, Rain, Peak discharge.
Identifiers: *Contour trenches, *Stabilization, *Annual grasses, San Dimas Experimental Forest.

After the 1960 fire, 20 experimental watersheds were given various erosion control treatments. From measurements made during four moderate sized storms in the 1962 hydrologic year it was concluded that side slope stabilization by contour furrow planting with barley was the most effective treatment. Because of its low cost, broadcast sowing of annual grass was also recommended. Contour trenches were found to be unsatisfactory because terrain and storm size made underdesign inevitable. Seeding of perennial grass was followed-up with herbicide to affect a conversion. This treatment resulted in very little vegetation and [illegible] celerated runoff and erosion. (Authors)
W69-08652

EMERGENCY REVEGETATION TO REHABILITATE BURNED WATERSHEDS [illegible] SOUTHERN CALIFORNIA,
Forest Service (USDA), Berkeley, Calif. Pac
Southwest Forest and Range Experiment Statio
E. S. Corbett, and L. R. Green.
US Forest Service Research Paper PSW-22, 19
14 p.

Descriptors: *Revegetation, *Demonstrat watersheds, *Competition, *Watershed mana ment, Burning, Grasses, Chaparral, Vegeta regrowth, Erosion control, Barley, Plant mana ment, Herbicides, Brush control.
Identifiers: *Experimental watersheds, *Bur watershed, *Plant competition, *Annual gr Broadcast seeding.

Reports 4-year results of revegetation meas tested for emergency erosion control after denuded the San Dimas Experimental Fores 1960, including establishment of seeded gra and their influence on recovery of native veg tion. (Authors)
W69-08654

SOIL SLIPPAGE INCREASED BY BRUSH CO VERSION,
Forest Service (USDA), Berkeley, Calif. Pac
Southwest Forest and Range Experiment Statio
Edward S. Corbett, and Raymond M. Rice.
US Forest Service Res Note PSW-128, 1966. 8 p

Descriptors: *Grasses, *Debris avalanc *Creep, *Brush control, Chaparral, Soil eros Mass wasting, Landslides, Rain, Burning, Slope bility, Soil mechanics.
Identifiers: Mass soil movement, *Soil slips. *Br conversion, Soil depth.

After a fire burned the San Dimas Experime Forest, near Glendora, Calif., in 1960, about acres of brushland were converted to grass. years later, the frequency and extent of soil slip a form of gravitational mass movement -- on acreage was compared with those on compara sites where brush cover was recovering natur after the fire. Both the area affected and number of soil slips were about five times gre on the grass-covered areas than on the brush ar (Authors)
W69-08655

WATER REPELLENT SOILS AND TH RELATION TO WILDFIRE TEMPERATURE
Forest Service (USDA), Berkeley, Calif. Pac
Southwest Forest and Range Experiment Statio
For primary bibliographic entry see Field 02G
W69-08657

FORMATION OF NON-WETTABLE SOILS... VOLVES HEAT TRANSFER MECHANISM.
Forest Service (USDA), Berkeley, Calif. Pac
Southwest Forest and Range Experiment Statio
For primary bibliographic entry see Field 02G
W69-08658

SOIL WETTABILITY AND WETT AGENTS...OUR CURRENT KNOWLEDGE THE PROBLEM,
Forest Service (USDA), Berkeley, Calif. Pa
Southwest Forest and Range Experiment Statio
For primary bibliographic entry see Field 02G
W69-08659

D GERMINATION AND ESTABLISHMENT AFFECTED BY NON-WETTABLE SOILS WETTING AGENTS,
st Service (USDA), Berkeley, Calif. Pacific thwest Forest and Range Experiment Station; California Univ., Riverside.
primary bibliographic entry see Field 02G.
9-08660

SONAL DEBRIS MOVEMENT FROM EP MOUNTAIN SLIDE SLOPES IN THERN CALIFORNIA,
st Service (USDA), Berkeley, Calif. Pacific thwest Forest and Range Experiment Station.
S Krammes.
DA Misc Pub 979, 1965, p 85-89.

criptors: *Erosion, *Watershed management, celerated erosion, *Scour, *Sediment yield, et erosion, Alluvium, Creep, Geomorphology, mentation, Forest fires, Mountain forests.
tifiers: Southern California, Chaparral ersheds, *Debris movement.

marizes debris measurements during a 9-year od at nine sites in the San Gabriel Mountains. accelerated eroision after the fire accentuated difference in erosion rates observed before the The south rejuvenated slopes showed a tenfold ease in debris production, 90 percent of which urred during the dry season. (Author)
9-08664

RE SCIOTO-SANDUSKY CONSERVANCY TRICT (FLOOD CONTROL DISTRICTS).
primary bibliographic entry see Field 06E.
9-08777

TERSHEDS.
primary bibliographic entry see Field 06E.
9-08785

TABLISHMENT OF WATERSHED DIS-ICTS.
primary bibliographic entry see Field 06E.
9-08786

NCTIONS AND AUTHORITY OF TERSHED DISTRICT MANAGERS.
primary bibliographic entry see Field 06E.
9-08787

TERSHEDS AND DRAINAGE SYSTEMS.
primary bibliographic entry see Field 06E.
9-08788

OVISIONS RELATING TO FLOOD CON-OL COMPACT.
primary bibliographic entry see Field 06E.
9-08793

MS AND DRAINS; GENERAL PROVISIONS.
primary bibliographic entry see Field 06E.
9-08794

K DITCHES.
primary bibliographic entry see Field 06E.
9-08798

STRUCTIONS AND DAMAGE TO ROADS.
primary bibliographic entry see Field 06E.
9-08799

SSAWAY V TRAVELERS INS CO (DAMAGE OM UNDISCLOSED STORM SEWER).
primary bibliographic entry see Field 06E.
9-08809

DRAINAGE AND FLOOD CONTROL.
For primary bibliographic entry see Field 06E.
W69-08825

TRANSIENT CONTROL IN THE LOWER SACRAMENTO RIVER,
California State Dept. of Water Resources, Sacramento.
Fred J. Gientke.
Pap, Tech Memo No 39, Dep Water Resour, State Calif, Sept 1968. 36 p, 13 fig, 11 ref, 2 append.

Descriptors: *Hydraulic transients, *Weirs, Transients, Forecasting, Unsteady flow, *Gate control, *Gates, Automatic control, Control, Flow profiles, *Flood control, Hydraulics.
Identifiers: Sacramento River (Calif), American River (Calif), Transient flow.

During periods of high water on the Sacramento River, the City of Sacramento is protected by opening the gates of the Sacramento Weir, located several miles above the city. The transient-controlling gate and valve stroking concept was used in developing the plan of operation. Basic unsteady-state equations used in calculating river profiles during flood periods are given. A method for selecting a compatible dx and dt is discussed. System boundary conditions and methods for solving for system inflow and outflow are presented. The treatment assumes the availability of initial steady-state conditions in the conveyance system, providing background material that will be used for developing the technique for controlling transients in the Sacramento River. In addition to the Sacramento Weir, such a capability can be extended to the operation of the San Joaquin River, the lower San Joaquin River flood control project, and is being considered for operating various reaches of the California State Water Project. (USBR)
W69-08844

4B. Groundwater Management

THE RESEARCH OF FRESH WATER IN A SALINE ENVIRONMENT,
P. Lenk.
Int CONF on Water for Peace, Vol 2, p 862-868, 1968. 7 p, 3 fig, 1 ref. For 8-volume proceedings see Vol 2, No 9, 06B, W69-03305.

Descriptors: *Arid lands, *Alluvial channels, *Artificial recharge, Aquifer characteristics, Deltas, Groundwater recharge, Recharge wells, Underground streams, Coastal plains, Freshwater-saline water interfaces.

This paper describes procedures for coastal plains and river delta freshwater search, and presents a method of recharge in arid zones. An example of water search in the horizontal aquifers near Karachi, Pakistan is outlined. A 'linear' survey was substituted for an 'areal' survey and a 'channel' of low velocity, decreasing downstream was discovered. Other examples of 'channels' of freshwater passing through underground salt water are presented from Dahomey and Eastern Pakistan. The causes of these 'channels' are not fully understood, but may depend on their low velocities. Slumping of alluvial formations in large deltas increases their gradient and their water collecting ability. Data show that no single sheet of water is present, but rather a multitude of 'channels', the independence of which disappears downstream as deposits of silt stop water movement. Water search is best accomplished by transverse lines of boreholes across the delta. Details of a recharging method are presented. (Sherbrooke-Ariz)
W69-08686

TOWARD FULL WATER UTILIZATION IN SAUDI ARABIA,
For primary bibliographic entry see Field 03C.
W69-08687

INCREASING THE INTENSITY OF DRAINAGE OF THE GROUND BY VACUUMING,
Ministry of Melioration and Water Resources Management (USSR).
I. V. Minayev, T. P. Gorezko, A. A. Vasil'yevskiy, and R. F. Lukoshko.
Soviet Hydrol: Selec Pap, Issue No 2, p 171-178, 1968. 8 p, 4 fig, 3 tab, 4 ref.

Descriptors: *Drainage, *Drainage systems, *Tile drainage, *Vacuum drying, Pumping, Aeration, Subsurface drainage, Drainage engineering, Model studies, Hydraulic models, Land management.
Identifiers: Vacuum soil drainage systems.

The application of artificial vacuum to tile drain systems to enhance water table lowering and to increase soil aeration was evaluated by laboratory tank and flume studies. Moisture content of wet soils can be reduced by increasing drain depth, reducing drain spacing, and by applying vacuum. The use of vacuum pumps can be less expensive than deepening drains or changing their spacing. (Knaap-USGS)
W69-08731

NEW THRUSTS IN GROUND WATER,
Geological Survey, Washington, D. C.
C. L. McGuinness.
Ground Water, Vol 7, No 2, p 7-10, Mar-Apr 1969. 4 p, 2 ref.

Descriptors: *Groundwater, *Aquifers, Forecasting, Water supply, Waste disposal, *Underground water storage, Fresh water, Groundwater recharge, Demineralization, Desalination, Water management (Applied), Systems analysis, Injection wells.
Identifiers: Saline ground water, Groundwater hydrology.

Four principal trends in ground water are apparent: (1) Increasing use will be made of ground water for domestic supplies. Geohydrologists must learn to evaluate quantitatively the water supply under conditions of maximum development. (2) Aquifers will be evaluated as possible storage media for surplus flood water, in place of dams and reservoirs. The key here is economics--optimum use of resources. (3) Saline aquifers will be viewed as sources of water supply. The cost curves of developing new supplies of fresh water are ascending while the cost curves for desalinization are declining, and inevitably they will cross. (4) With efforts to prevent stream pollution, aquifers will be considered as possible storage media for industrial and domestic waste effluents. Control is needed so that the effects of waste injection can be predicted, the technology for confining those effects as intended can be developed, and a basis can be provided for a rational decision as to whether waste injection or an alternative use of the chosen aquifer is best for the economy. A systems-analysis approach is needed to develop a working model of a given hydrologic and socio-economic problem from which quantitative answers can be given to water planners. (USBR)
W69-08864

NEED FOR SALINE GROUNDWATER DATA TO ADVANCE DESALTING TECHNOLOGY,
Office of Saline Water, Washington, D. C.
For primary bibliographic entry see Field 03A.
W69-08867

4C. Effects on Water of Man's Non-Water Activities

URBAN WATER RESOURCES RESEARCH,
American Society of Civil Engineers, New York. Urban Hydrology Research Council.
M. B. McPherson.
Amer Soc Civil Eng Annu Prog Rep, 1968. 43 p, 4 fig, 3 tab, 38 ref, 11 append. L. S. Tucker, Director.
Work supported by OWRR, Dept of Interior. OWRR Contract No 14-01-0001-1585.

Descriptors: *Urbanization, *Rainfall-runoff relationships, *Systems analysis, *Surveys, Data collections, Hydrologic data, Model studies, Research and development.
Identifiers: *Urban hydrology, Urban water resources.

Activities in urban water resources research by ASCE in 1967-1968 are reported. The objective of the research is to provide guidelines for ititiating and expanding a program of long-range studies in urban water problems. Considerable attention was given to storm drainage to arrive at mathematical descriptions of the rainfall-runoff relationship, to predict pollution loads, and to develop methods of planning water quantity, quality, and drainage development. Data collection system design and data requirements are discussed. Systems analysis, statistical studies, and model studies are being initiated. Considerable attention was given to research needs in political, economic, social, legal, and related aspects of urban hydrology. Appendices contain technical and feasibility studies of modeling, flood damages, non-hydrological aspects, research needs, systems engineering, and economics. (Knapp-USGS)
W69-08743

THE FINGER PLAN - A CONCEPT OF ORDER.
Northeastern Illinois Planning Commission, Chicago, Ill.
For primary bibliographic entry see Field 06B.
W69-08877

STATISTICAL APPENDIX,
Nevada Univ., Reno. Div. of Agricultural Economics and Education; and Nevada Univ., Reno. Max C. Fleischmann Coll. of Agriculture.
George A. Myles.
Max C. Fleischman College of Agr, Univ of Nevada, Pub No B18, Feb 1968. 80 p, 40 tab, 2 exhibits.

Descriptors: *Recreation demand, *Data collections.

This publication is the statistical appendix to the series of publications concerning the demand for water based recreation in Nevada. This publication contains statistical material on which previous material was based. (Grossman-Rutgers)
W69-08964

ECONOMIC IMPACT OF RECREATIONAL DEVELOPMENTS IN THE RESERVE RANGER DISTRICT,
New Mexico State Univ., University Park. Dept. of Agricultural Economics.
James R. Gray, and Garrey E. Carruthers.
Agricultural Experiment Station, New Mexico State University, Bulletin 515, Nov 1966. 25 p, 1 fig, 14 tab, 1 append, 5 ref.

Descriptors: *Input-output analysis, *Economic impact, *Recreation, Sampling, Multi-purpose reservoirs.
Identifiers: *Reserve Ranger District of New Mexico.

This study determined how local industries in west-central New Mexico would be affected by an increase in recreational activities. A multi-purpose reservoir was proposed. Input-output analysis was used to determine how this project would affect the local industries. Included in the study are physical and economic descriptions of the reserve area. The results include a flow table of industry flows of goods and services, a table of technical coefficients which shows the monetary value produced or used in each sector per dollar of production, the economic impact of increased recreational activity, and the impact of increased activity on water and land requirements of local industries. A conclusion is given. The appendix illustrates the development of the descriptive model used in the input-output analysis. (Grossman-Rutgers)
W69-08967

ECONOMIC DEVELOPMENT THROUGH PLEASURE AND PROFIT,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics.
Dan Badger, and Dean Barrett.
First Annual Oklahoma Outdoor Recreation Conference Proceedings, March 9 and 10, 1967. 121 p.

Descriptors: *Recreation, *Recreation demand, Consumptive use.
Identifiers: *Oklahoma.

The conference included those interested in outdoor recreation from both the public and private sectors of Oklahoma. The orientation of the discussions was the potentials for the problems of outdoor recreation. Some of the topics covered were: demand for recreation in Oklahoma, consumer preferences, development of state recreation facilities, water based hunting, and loans available for recreation. (Grossman-Rutgers)
W69-08971

4D. Watershed Protection

SNOW ACCUMULATION AND DISAPPEARANCE BY ASPECT AND VEGETATION TYPE IN THE SANTA FE BASIN, NEW MEXICO,
Forest Service (USDA), Albuquerque, N. Mex. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 02C.
W69-08645

SOIL TEMPERATURES UNDER FOREST AND GRASSLAND COVER TYPES IN NORTHERN NEW MEXICO,
Forest Service (USDA), Albuquerque, N. Mex. Rocky Mountain Forest and Range Experiment Station.
Howard L. Gary.
US Forest Serv Res Note RM-118, 1968. 11 p, illus.

Descriptors: *Temperature, *Vegetation effects, *Snow cover, *Snow management, *Watershed management, Soil environment, Cold regions, Frozen soils, Temperature control, Mountain forests, Coniferous forest, Weather data, Soil temperature, New Mexico.

Temperatures for selected soil depths (1.5 to 112 inches) under aspen, Douglas-fir, spruce-fir and grassland types on north- and south-facing aspects from 9,900 to 11,150 feet above m.s.l. are reported for 1 year. Plant cover type was more important in modifying soil temperature than aspect, elevation, or snow cover. Average annual temperature for the first 12 inches of soil ranged from 33.2 deg F on the north-aspect spruce-fir at 11,150 feet to 40.8 deg F on the south-aspect aspen at 9,900 feet. Depth of freezing temperatures during the period of snow cover ranged from 1.5 to 3 feet. (Author)
W69-08646

WATERSHEDS ASSUME IMPORTANT ROLE IN FOREST MANAGEMENT IN HAWAII,
Forest Service (USDA), Honolulu, Hawaii. Pacific Southwest Forest and Range Experiment Station.
Robert E. Nelson.
Western Conservation Journal, Vol 21, No 6, p 56-57, 1965. 6 fig.

Descriptors: *Watershed management, *Hawaii, Forestry, Forest management, *Vegetation effects, Erosion control, Reforestation.
Identifiers: *Multiple use, *Forestry research.

While water is the most important resource of Hawaii's forest lands, other products and uses can be compatible with good watershed management. A forestry research program is underway to develop knowledge to support multiple-use management. (Merriam-Forest Serv)
W69-08650

IN HAWAIIAN WILDLANDS WA BECOMES THE MOST IMPORTANT FOR CROP,
Forest Service (USDA), Honolulu, Hawaii. Pa Southwest Forest and Range Experiment Statio
Paul D. Duffy.
Western Conservation Journal, Vol 21, No 6, p 59, 1965. 2 fig.

Descriptors: *Land use, *Hawaii, Water management, Reforestation, *Vegetation eff Erosion control, Condensation, Forest man ment.
Identifiers: Fog drip, Multiple use.

Watersheds have been protected for their w supply by the Hawaii Division of Forestry for n 75 years. The U.S. Forest Service believes possible for Hawaii to have its water and re other values from forest lands too. (Mer Forest Serv)
W69-08651

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

WHEN DO STREAM TEMPERATU BECOME A PROBLEM,
Philadelphia Electric Co., Pa. Dept. of Enginee and Research; and Cornell Univ., Ithaca, N.Y. of Biological Sciences.
For primary bibliographic entry see Field 05B.
W69-08708

STRUCTURE OF THE WATER BALANCE BODIES OF WATER,
Ministry of Melioration and Water Resou Management (USSR).
For primary bibliographic entry see Field 02D.
W69-08729

DESCRIPTION OF THE DRAINAGE STREET FLUSHING WATERS,
Ministry of Melioration and Water Resou Management (USSR).
N. A. Pravoshinskiy.
Soviet Hydrol: Selec Pap, Issue No 2, p 168- 1968. 3 p, 2 tab, 9 ref.

Descriptors: *Water pollution sources, *Ro *Urbanization, *Drainage systems, Storm dr Municipal wastes, Oily water, Organic wastes, ments.
Identifiers: *USSR, Street cleaning wastes, M Moscow, Leningrad.

The quality and quantity of runoff from s washing operations in Minsk were measure study the contribution of street washing to pollution. Data from earlier studies in Moscow Leningrad are included for comparison. The of street cleaning runoff is 6-223 mg/liter, pet um products are up to 110 mg/liter, and colif are nearly as abundant as in wastewater. T waters, unless they are treated, can be a r source of pollution. (Knapp-USGS)
W69-08732

OCCURRENCE AND DISTRIBUTION PHENOLIC COMPOUNDS IN NEW JERS STREAMS,
Samuel D. Faust, Peter W. Anderson, and Hansjakob Stutz.
1969 ASME/AIChE Stream Pollution Abate Conference - June 12, 1969, Paper 69-PID-9 gers University. 8 p, 4 fig, 3 tab, 9 ref.

Descriptors: *Phenols, *Organic compo *Water pollution effects, *Analytical techni Industrial wastes, Water pollution, Water poll

rces, Water quality, Chemical analysis, Chemi-
properties, Chemical reactions, Data collec-
s.
ntifiers: *Taste and odor, Chlorophenols,
ogenated phenols, Palatable water.

face waters are receiving and transporting
er and larger volumes of domestic and industri-
waste waters that may contain phenolic com-
nds. One of the more serious aspects of this
er-quality problem is the lack of specific and
sitive analytical techniques for the detection of
se compounds. In order to test the applicability
an improved 4-aminoantipyrine colorimetric
cedure to natural waters, a program was un-
taken to sample systematically 24 sites in six
r systems and four ground-water sites in New
sey and to examine these samples for phenol.
s reconnaissance survey reveals concentrations
xcess of 1.0 ug/l which is the 'recommended
able water-quality standard' established by the
w Jersey State Department of Health. (Faust-
gers)
9-08972

IMPROVED METHOD FOR EXTRACTION ORGANOCHLORINE AND OR-NOPHOSPHATE INSECTICIDES FROM KE WATERS,
sconsin Univ., Madison.
r primary bibliographic entry see Field 02H.
9-09016

E MOVEMENT AND STORAGE OF WATER NORTH CAROLINA SOILS AND THE ROLE THE SOIL IN DETERMINING WATER ALITY,
rth Carolina Univ., Chapel Hill. Water sources Research Inst.
r primary bibliographic entry see Field 02G.
9-09028

3. Sources of Pollution

W HERBICIDE CONCENTRATION FOUND STREAMFLOW AFTER A GRASS COVER IS LLED,
est Service (USDA), Franklin, N.C. Southeast-Forest Experiment Station.
. Douglass, D. R. Cochrane, G. W. Bailey, J. I. sley, and D. W. Hill.
Forest Serv Southeast. Forest Expt Station er No SE-108, 1969. 4 p.

scriptors: *Herbicides, *Water quality, *2-4-D, raquat, Water pollution, Watershed manage-nt, North Carolina, Agricultural chemicals, ticides, Pesticide residues.
ntifiers: *Atrazine, *Experimental watersheds, weeta hydrologic laboratory.

grass cover on a steep Appalachian watershed sprayed in 1966 with herbicides--first with zine and paraquat and later with atrazine and -D. Although grass growing in the stream chan-was sprayed during the first treatment, atrazine paraquat levels in water samples were low. For second treatment, a 10-foot strip on either side he channel was left unsprayed. No increase in zine concentration was noted, and no 2,4-D detected. Thus, use of these chemicals does not ear to constitute a water pollution hazard when sonable care is taken to protect streamside etation and the stream from direct contamina-. (Author)
9-08642

STICIDES AND POLLUTION,
eau of National Affairs, Inc., Washington, D.C.
primary bibliographic entry see Field 05C.
9-08707

WHEN DO STREAM TEMPERATURES BECOME A PROBLEM,
Philadelphia Electric Co., Pa. Dept. of Engineering and Research; and Cornell Univ., Ithaca, N.Y. Div. of Biological Sciences.
Stanley Moyer, and Edward C. Raney.
Preprint No 834, Amer Soc Civil Eng Annu and Nat Meeting on Water Resources Eng, Feb 3-7, 1969, New Orleans, La, 1969. 42 p, 13 fig, 11 tab.

Descriptors: *Heated water, *Thermal power-plants, *Water temperature, *Biology, *Rivers, Reservoirs, Pennsylvania, Maryland, Water pollu-tion sources, Waste water disposal, Water pollution control.
Identifiers: *Susquehanna River, Thermal discharges.

The effects of present and proposed thermal discharges on water temperatures in the Susquehanna River basin are discussed and the results of high water temperatures on aquatic life are surveyed. A model was constructed of the Conowingo Reservoir to study thermal discharges, water withdrawals, and the thermal budget. Isotherm plots show that under the most adverse conditions of record, the proposed cooling tower installation at the Peach Bottom powerplant can produce a satisfactory effluent temperature. No thermal barriers to fish migration are present. No reduction in species diversity is foreseen. No reduc-tion in dissolved oxygen is expected. (Knapp-USGS)
W69-08708

DESCRIPTION OF THE DRAINAGE OF STREET FLUSHING WATERS,
Ministry of Melioration and Water Resources Management (USSR).
For primary bibliographic entry see Field 05A.
W69-08732

OIL POLLUTION: PROBLEMS AND POLICIES,

Bur Nat Aff Environ Manage Ser Rep, 1969. 142 p, 1 fig, 2 tab, 94 ref. Degler, Stanley E., Editor.

Descriptors: *Oily water, *Water pollution sources, *Ships, *Water pollution control, Legisla-tion, Cleaning, Regulation, Water pollution treat-ment, International law, Water law.
Identifiers: Shipwrecks, Oil spills, Oil pollution acts.

Oil pollution caused by spillage from ships, ship-wrecks, and other sources is discussed. Oil spillage control, cleanup, existing oil pollution legislation, and proposed laws are reviewed. The present state of oil spillage prevention, control, and restoration technology is outlined. The National Multi-Agency 0.1 and Hazardous Materials Pollution Contingen-cy Plan is excerpted. Texts of the oil pollution acts of 1924 and 1961 are included. (Knapp-USGS)
W69-08752

DISPOSAL OF WASTEWATER FROM WATER FILTRATION PLANTS.
For primary bibliographic entry see Field 06E.
W69-08816

SUSQUEHANNA RIVER BASIN COMPACT - WATER SUPPLY AND WATER QUALITY MANAGEMENT AND CONTROL.
For primary bibliographic entry see Field 06E.
W69-08845

RESEARCH ON GROUND-WATER CONTAMINATED BY DEPOSITS OF SOLID WASTE,
Hessiches Landesamt fuer Bodenforschung, Wiesbaden (West Germany).
Arthur Golwer, and Georg Matthess.
Symp on Geoche, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 129-133, 1968. 5 p, 4 ref.

Descriptors: *Waste disposal, *Waste dumps, *Leaching, *Path of pollutants, Biodegradation, Degradation (Decomposition), Sorption, Reduc-tion (Chemical), Oxidation, Municipal wastes, In-dustrial wastes.
Identifiers: Surficial solid waste disposal.

The effects of solid waste disposal practices on groundwater quality was studied at large municipal and industrial disposal sites. Leaching causes a rise of dissolved organic and inorganic material in groundwater. The organic components are rapidly degraded by soil microorganisms. Anaerobic con-ditions caused by degradation of organic wastes cause reduction of dissolved inorganic wastes in a zone of only a few meters width immediately downstream from the disposal site. In this zone, dis-solved iron concentrations as high as 21 ppm have been measured. Most inorganic contaminants are sorbed within a short distance of their sources, limiting the zone of groundwater contamination to definite boundaries. (Knapp-USGS)
W69-08918

THE EFFECTS OF TEMPERATURE AND DEN-SITY GRADIENTS UPON THE MOVEMENT OF CONTAMINANTS IN SATURATED AQUIFERS,
Alabama Univ., University. Dept. of Engineering Mechanics.
For primary bibliographic entry see Field 02F.
W69-08921

THE EFFECT OF CATION-EXCHANGE CAPACITY ON THE RETENTION OF DIQUAT AND PARAQUAT BY THREE-LAYER TYPE CLAY MINERALS: 2. PLANT AVAILABILITY OF PARAQUAT,
North Carolina Agricultural Experiment Station, Raleigh.
J. B. Weber, R. C. Meek, and S. B. Weed.
Soil Sci Soc Amer Proc, Vol 33, No 3, p 382-385, May-June 1969. 4 p, 3 fig, 13 ref.

Descriptors: *Adsorption, *Herbicides, *Clay minerals, *Phytotoxicity, Soil chemical properties, Organic compounds, Montmorillonite, Kaolinite, Ion exchange, Dequat, Paraquat.
Identifiers: Vermiculite.

Paraquat was adsorbed on varying amounts of Ca-montmorillonite and Ca-vermiculite. The herbi-cide-treated clays were added to a synthetic soil medium and cucumber seedlings were planted. Ca-montmorillonite effectively reduced the activity of approximately 90 to 95% of the adsorbed paraquat leaving only 5 to 10% available to the plants. Ap-proximately 10% was also found to be exchangea-ble using .005 N solutions and is believed to be that which is adsorbed on external surfaces. The results are analogous to those found with other montmoril-lonites and suggest that the major portion of dipyridinium herbicides that are adsorbed on this clay mineral is probably adsorbed in a biologically unavailable form. Ca-vermiculite reduced the phytotoxicity of paraquat, but did not remove the phytotoxic effects completely. Substantial amounts of paraquat were also released from this clay mineral using salt solutions. The results are analogous to previous findings with kaolinite clay and suggest that the adsorption of this herbicide by soils in which vermiculite and kaolinite are the dominant clay minerals is probably largely in a biologically available form. (Knapp-USGS)
W69-08957

DETERMINATION OF ORGANOCHLORINE INSECTICIDES IN SOILS AND WATERS,
Wisconsin Univ., Madison.
H. B. Pionke, and G. Chesters.
Soil Science Society of America Proceedings, Vol. 32, No. 6, November-December 1968, 11 p, 82 ref, p 749-759. OWRR Proj B-016-Wis.

Descriptors: *Degradation, *Gas-chromatography, Insecticides.
Identifiers: *Organochloride insecticides, Volatization, Insecticide extraction.

Pertinent references on the determination of organochloride insecticides in soil and water samples are reviewed. The particular methods are chosen because of their applicability to heterogeneous systems which often provide problems due to coextraction of indigenous components. The review is divided into three principal sections, i.e., extraction of organochlorine insecticides from soils and waters, cleanup of soil and water extracts, and analysis of purified soil and water extracts. Criteria used in evaluating extraction procedures were based on methods of equilibrating the insecticide with the soil sample and the control of possible insecticide losses through degradation and volatization. In the section on cleanup procedures special attention is devoted to chromatographic methods, particularly column and thin-layer chromatography. A large portion of the methods of final analysis of purified extracts is given over to gas-liquid chromatographic techniques because of the preponderance of its use for insecticide determination. The gas-liquid chromatographic methods are discussed on the basis of peak resolution, detection and measurement of the insecticides, and confirmation of their identity. Thin-layer chromatographic, spectrophotometric, and other methods of determination of organochlorine insecticides in purified extracts are evaluated. (Pionke-Wis)
W69-09018

MEASUREMENT OF BIOLOGICAL N2 FIXATION,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 02H.
W69-09021

5C. Effects of Pollution

CHARACTERISTICS AND SIGNIFICANCE OF RESISTANCE TO INSECTICIDES IN FISHES,
Mississippi State Univ., State College. Dept. of Zoology.
Denzel E. Ferguson.
Southern Div Amer Fish Soc, Reservoir Fishery Resources Symposium, p 531-536, 1967. 12 ref.

Descriptors: *DDT, *Aldrin, *Dieldrin, *Endrin, Pesticides, Fish, Shiners.
Identifiers: *Pesticide resistance, Bluegill, Gambusia, Green sunfish.

Several species of freshwater fishes of the Mississippi Delta region exhibit resistance to a variety of pesticides. Populations of bluegill, green sunfish and golden shiners were found to be resistant to endrin, aldrin, dieldrin and toxaphene, but susceptible to DDT. Pesticide-resistant populations apparently develop as a result of intraspecific variations in tolerance; bioassays of fish from pesticide-free areas reveal rare individuals with high tolerances, suggesting preadaptive genetic mechanisms. Levels of resistance are apparently related to the chemical stability of the pesticide. Resistant populations may accumulate sufficient levels of pesticides to constitute a hazard to susceptible populations of organisms, including man. Several examples of pesticide-resistant fish and their effects on susceptible fish are cited. (Voightlander-Wis)
W69-08667

CHEMICAL FERTILIZERS ON LAKE WATERS (IN GERMAN),
Von Heinz Ambuhl.
Summaries in English and French. Gas- und Wasserfach, Vol 107, No 14, p 357-363, Apr 1966. 6 fig, 2 tab, 18 ref.

Descriptors: *Eutrophication, *Nutrients, *Lakes, Ponds, Fertilizers, Algae, Nitrogen, Phosphorus, Water pollution effects, Water pollution sources, Water pollution control, Oxygen balance, Sewage, Runoff.
Identifiers: Lake Lucerne, Fertilized fields, Subterranean drainage, Mechanical and biological purification, Switzerland.

The pollution of lakes and ponds is in a large part due to inorganic salts promoting algal growth and subsequent processes of decomposition. As revealed by studies of Lake Lucerne, a few parts per million of fertilizer salts, particularly phosphates, are sufficient to stimulate the growth of algae and upset the oxygen balance. A large fraction of eutrophying substances is brought to lakes from fertilized fields via run-off and subterranean drainage. The amount of phosphorus from these sources is equal to that supplied by the normal discharges of sewage; the amount of nitrogen delivered from fields exceeds that contributed by sewage. On the average, Swiss lakes receive 0.3 to 0.5 kg of phosphorus and about 45 kg of nitrogen per hectare, per year; the latter figure is derived from a very wide amplitude. This inflow of nutrients is sufficient to eutrophy lakes, but the only corrective measure available at this time is purification of the sewage by mechanical and biological methods eliminating plant nutrients. (Wilde-Wis)
W69-08668

EFFECTS OF TEMPERATURE AND BODY WEIGHT ON ENDOGENOUS NITROGEN EXCRETION IN THE BLUEGILL SUNFISH (LEPOMIS MACROCHIRUS),
Indiana Univ., Bloomington. Dept. of Zoology.
Jan Savitz.
J Fish Res Board Canada, No 26, p 1813-1821, 1969. 2 fig, 4 tab, 17 ref.

Descriptors: *Metabolism, *Nitrogen, *Temperature, Proteins, Sunfishes.
Identifiers: *Lepomis macrochirus, *Nitrogen excretion, Protein maintenance.

The protein maintenance level for a population of bluegill sunfish was estimated on a seasonal and yearly basis. Effects of temperature (range: 7.2 to 32.2 deg C) and body weight on endogenous nitrogen excretion (ENE) were determined by feeding a non-protein diet (glucose). Values of weight exponents in weight-metabolic rate relationship (log Y= log a+ b log W) were nearly identical for all temperatures. Mean rates of nitrogen excretion for two size groups of fish (10 and 100 grams) increased with rising temperature, with rates at 29 to 32 deg C being exceptionally high and significantly different from rates obtained at lower temperatures. No resistance adaptation was noted at high temperatures. Protein maintenance levels were estimated at 15.29 kilograms protein for summer (June-August) and 2.43 kilograms for any 30-day period from September through May, based on population of 6260 fish. The total (annual) maintenance level was estimated at 37.54 kilograms. Graphical data include body weight-metabolic rate relationships and maintenance nitrogen levels. Tabular data include nitrogen excretion rates at different temperatures and ENE rates by age group. (Voightlander-Wis)
W69-08670

EUTROPHICATION OF INLAND WATERS.
Water Pollution Research Lab., Stevenage (England).

Ministry of Technology Notes on Water Pollution, No 41, 4 p, June 1968. 1 fig, 2 tab, 12 ref.

Descriptors: *Eutrophication, *Nutrients, *Lakes, Oligotrophy, Sewage effluents, Nitrogen, Phosphorus, Detergents, Fertilizers.
Identifiers: *Assessment of eutrophication, *Utilization of nutrients, *Sources of nutrients, *Control of eutrophication, Inland waters, Algal nuisance, Algal blooms, Agricultural runoff, Nutrient removal, Lake Zurich, Lake Washington (Wash), River Lee, River Thames, Great Ouse, England, Switzerland.

Eutrophication is the natural aging of lakes, hastened by man's activities, which may give r such problems as taste and odor in water sup filter clogging, disappearance of game fish, ar terference with recreation. To quantitatively d the degree of eutrophication many methods m used: measurement of dissolved oxygen, rat oxygen depletion, biological productivity, t parency, nutrient level, and chlorophyll 'a' co of surface waters. Newly developed is a for bioassay involving culture techniques with s algal species for measuring the growth-prom properties of various waters and effluents. Fa necessary for algal growth have been studied, nitrogen and phosphorus believed to be the r nutrients controlling algal growth; they are als most prominent nutrients in sewage effluents fertilizers. The greatest single source of nitr and phosphorus in surface water is agricultur noff; however, much phosphate enters domestic sewage greatly enriched in recent by detergents. To control eutrophication nutr rich waters can be diverted, as in Lake Washin or nutrients removed from effluents. Phosp can be reduced using lime, ferric, or alum hydroxides; nitrate by microbial denitrifica and ammonia by air-stripping--all at conside cost and with limited success in eliminating problem. (Ketelle-Wis)
W69-08672

UPTAKE AND LOSS OF RADIONUCLIDES THE FRESHWATER CLAM LAMPS RADIATA (Gmel),
Du Pont de Nemours (E. I.) and Co., Aiken. Savannah River Lab.
R. S. Harvey.
Health Physics, Vol 17, p 149-154, Pergamon 1969. 4 fig, 3 tab, 8 ref.

Descriptors: *Radioisotopes, *Fresh w *Clams, Indicators, Cesium, Stron radioisotopes, Zinc radioisotopes, C radioisotopes, Manganese, Chromium, Se Streams, Effluent streams, Limnology, Spectr ters, Radiochemical analysis, South Carolina
Identifiers: *Uptake, *Loss, Lampsilis rad Savannah River Plant (S.C.), Cerium-144, So sues, Shells, Concentration factors, Biological life.

The uptake and loss of radionuclides by the f water clam Lampsilis radiata (Gmel), were stu under natural stream conditions at the Sava River Plant. The species, common to the Sava River, was found to be a good biological indi of industrially released radionuclides. Specime a reactor effluent stream were exposed for 91 to very low concentrations of cerium-144, ces 137, strontium-90, zinc-65, cobalt-60, manga 54, chromium-51, and sulfur-35, and then t ferred to a nonradioactive stream for retentio dies. Loss of radionuclides from soft tissue measured for 56 days. Except for strontium-9 radionuclides studied were concentrated in th tissues; only strontium-90, manganese-54, and um-137 were concentrated significantly in s At apparent equilibrium, concentration factor soft tissues were 220 for cesium-137, 240 fo fur-35, 440 for chromium-51, 790 for cobal 900 for cerium-144, 2400 for manganese-54 4100 for zinc-65. Retention studies showed th biological half-life of each radionuclide in so sues consisted of both short and long-lived ponents (days): cerium-144 (2.0, 34), cesiu (3.0, 38), zinc-65 (3.5, 40), sulfur-35 (4.8 chromium-51 (5.0, 52), manganese-54 (2.8 and cobalt-60 (4.8, 277). Short-lived compo represented 34-61% of radioactivity in soft tis (Jones-Wis)
W69-08673

UPTAKE OF DIELDRIN BY ISOLATED E FUSED GILLS OF RAINBOW TROUT,
Michigan State Univ., East Lansing. De Physiology.
Paul O. Fromm, and Robert C. Hunter.
J Fish Res Board Canada, No 26, p 1939-1 1969. 1 fig, 1 tab, 6 ref

iptors: *Dieldrin, *Rainbow trout, Gas chro-graphy.
ifiers: Transfer studies, Physiological prepara- Uptake.

al workers have suggested that fish uptake of ticides, including dieldrin, occurs primarily e gills. Uptake of dieldrin by isolated gill-arch rations was studied, using three perfusates: rs solution, TC-199 (Difco), and heparinized a. Preparations were exposed to bath solu- of 1000 parts per billion dieldrin in ethanol on. Transfer of dieldrin from the environmen- ater occurred only when plasma protein or a lipoprotein was present as the perfusate. fer was passive. Authors suggest that dieldrin related insecticides diffuse through the gills ecome dissolved in the lipid portion of plasma rotein. Graphical and tabular data include gs of gas chromatograms and summary of ex- ental data. (Voightlander-Wis)
08677

TING AND CALCIFICATION IN DAPHNIA NA,
Univ., Berkeley. Sanitary Engineering arch Lab.; and California Univ., Berkeley. ol of Public Health.
ld B. Porcella, Charles E. Rixford, and John ater.
ological Zoology, Vol 42, No 2, p 148-159, 969. 8 fig, 1 tab, 21 ref.

riptors: *Crustaceans, *Daphnia, *Calcium, tium radioisotopes, Gamma rays, Tracers, edesmus, Bacteria, Temperature, Magnesium, isotopes, Radioactivity, Chlorella.
ifiers: *Daphnia magna, *Molting, *Calcifica- Exoskeleton, Half-life, Genotype, Uniformity Illumination, Beta rays, Autoradiographs, nuclide uptake, Daphnia schodleri, Observed concept, Radionuclide concentration, Yttri- 0, Carapace.

fication in Crustacea is a process limited arily to deposition of calcium salts in the ex- eton. Strontium, chemically similar to calci- is accumulated by various organisms in rela- to the calcium concentration. Because one of adioactive isotopes of strontium (Sr-85) has a vely long half-life and is a gamma emitter, it is ble to study calcification by observing deposi- f Sr-85 at different intervals within a molting . Since almost all the calcium and strontium is ized in exoskeleton, a clear description of aspects of calcium deposition and molting e determined by using Sr-85 to study the ical and kinetic relationships of calcification ole Daphnia. A hypothesis based on growth and relating accumulation to chemical brium between environmental strontium and m and deposition sites in the exoskeleton is sted as explaining calcification. Any factor affects synthesis or growth, such as tempera- has a direct effect on the calcium accumula- ate. Total accumulation of calcium and stron- is directly related to water concentrations and ifferential binding of calcium and strontium. f Sr-85 as a tracer for calcium in the calcifica- rocess appears to fit the observations. (Jones-
08678

CENTRATIONS OF THE NATURALLY URRING RADIONUCLIDES Ra-226, Pb-210 Po-210 IN AQUATIC FAUNA,
ne National Lab., Ill. Radiological Physics
rd B. Holtzman.
2nd Natl Symp on Radioecology, May 15-17, Ann Arbor, Mich. US Atomic Energy n, Doc CONF 670503, p 535-546. 6 fig, 2 tab, f. Available from Clearinghouse for Federal d Tech Information as CONF 670503.

iptors: *Radioisotopes, *Radium sotopes, *Lead radioisotopes, *Aquatic ls, Marine fish, Freshwater fish, Shellfish, Copepods, Hazards, Industries, Tracers, Calcium, Metabolism, Human population, Ecology, Food chains, Biota, Atlantic Ocean, Great Lakes, Pikes, Herrings, Pacific Ocean, Salmon, Clams, Oysters, Alaska, Perches, Age, Potassium radioisotopes, California.
Identifiers: *Polonium radioisotopes, *Concentrations, *Natural occurrence, Seals, Species, Fin whale, Sperm whale, Bone, Tooth, Muscle, Euphasiids, Euphausia pacifica, Anycholeuthis, Biosphere, Radon-222, Half-life, Lead-210-Bismuth-210-Polonium-210, Alpha particle, Life spans, Halibut, Flounder, Scotland, Tuna, Japan, Barrow, Whitefish, Kidney, Blubber, Strongylocentrotus purpuratus, Los Angeles, California, Meganyctiphanes norvegica, Alpha counter, Shell, Spines, Fluids, Soft tissue, Jaws, Anthropods, Exoskeleton, Liver, Cattle, Human bone, Human tissue, Caribou, Reindeer, Baleen, Mandible, Environmental dose, Cosmic rays, Eskimos.

Concentrations of radium-226 (Ra-226), lead-210 (Pb-210), and polonium-210 (Po-210), were determined in hard and soft tissues of freshwater and marine fish, shellfish, seals, whales, and in some dietary components of whales. Concentrations of Ra-226 at about 5 picocuries/100 gram bone ash and 0.2 picocuries/100 gram wet soft tissue were fairly constant among species. Concentrations of both Pb-210 and Po-210 in a given tissue were equal to or greater than those of the parent, Ra-226. In fish and seal bone, concentrations of Pb-210 and Po-210 were similar to those in human bone, about 15 picocuries/100 gram ash. Fish muscle contained about 0.2 picocuries Pb-210/100 gram wet, specific activities of Po-210 about 10-fold greater. Activities of both nuclides in soft tissues of clams, oyster, and squid were higher by one order of magnitude than in fish muscle. In bone and muscle taken from a fin whale, concentrations of these nuclides were similar to those in fish. By contrast, teeth from sperm whales had concentrations of Pb-210 one order of magnitude greater than those in bone of fin whales. Higher concentrations of Pb-210 in sperm whales seem correlated with those found in components of their diet--copepods, euphausiids, and possibly squid. (See also Vol 2, No 18, Field 5C, W69-07441). (Jones-Wis)
W69-08679

ENRICHMENT OF RADIOACTIVITY BY ARCTIC ECOSYSTEMS IN FINNISH LAPLAND,
Helsinki Univ. (Finland). Dept. of Radiochemistry.
J. K. Miettinen.
Proc 2nd Natl Symp on Radioecology, May 15-17, 1967, Ann Arbor, Mich. US Atomic Energy Comm, Doc CONF 670503, p 23-31. 6 fig, 4 tab, 14 ref. Available from Clearinghouse for Federal Sci and Tech Information as CONF 670503.

Descriptors: *Radioactivity, *Ecosystems, *Arctic, Cesium, Iron, Radiochemical analysis, Food chains, Lichens, Freshwater fish, Flood plains, Pastures, Milk, Strontium radioisotopes, Calcium, Potassium, Fallout, Iron, Nutrients, Aquatic populations, Pikes, Lakes, Lead radioisotopes, Arctic Ocean.
Identifiers: *Finnish Lapland, Reindeer, Body burdens, Whole body counting, Polonium-210, Blood, Half-life, Sedges, Horsetails, Cows, Fodder, Caribou, Helsinki, Finland.

Body burdens of cesium-137 for reindeer Finnish Lapps and a control group of southern Finns were determined by whole body counting and by radiochemical analyses of blood samples for iron-55 and polonium-210. While body burdens of the southern population are of the same order as those of western peoples in general, Lapps contain about 50-fold more cesium-137 and 10-fold more iron-55 and polonium-210, due mainly to their food chains: lichen to reindeer meat to man; for cesium-137, fresh water fish to man, and flooded riverside pastures to cow's milk to man. In many Lapland lakes, potassium content is so low that enrichment of cesium-137 by aquatic organisms is greatly increased. Cesium-137 content in pike in 1965 varied from 0.2 to 22 nannocuries per kilogram fresh-weight as a function of potassium content of the lake water, and similarly in cow's exclusive fodder (water plants, sedges and horsetails) content of cesium-137 varied 100-fold. Cow's milk and meat in Lapland contain about ten times more cesium-137 than in southern Finland. Stable iron in Finnish lakes from 30 to 1500 micrograms per litter, effecting more than 10-fold differences in content of iron-55 in fish. (See also Vol 2, No 18, Field 5C, W69-07441). (Jones-Wis)
W69-08680

INTERACTIONS OF IONIZING RADIATION, SALINITY, AND TEMPERATURE ON THE ESTUARINE FISH, FUNDULUS HETEROCLITUS,
Bureau of Commercial Fisheries, Beaufort, N.C. Radiobiological Lab.
J. W. Angelovic, J. C. White, Jr., and E. M. Davis.
Proc 2nd Natl Symp on Radioecology, May 15-17, 1967, Ann Arbor, Mich. US Atomic Energy Comm, Doc CONF 670503, p 131-141. 5 fig, 4 tab, 22 ref, disc. Available from Clearinghouse for Federal Sci and Tech Information as CONF 670503.

Descriptors: *Radioactivity, *Salinity, *Temperature, *Fish, *Estuaries, Sodium, Oxygen demand, Cobalt radioisotopes, Mathematical models, Time, Regression analysis.
Identifiers: *Fundulus heteroclitus, *LD-50, Efflux, Radiation dose, Osmoregulatory system, Multiple regression analysis.

Estuarine animals are characterized by capacity to adapt to widely varying conditions. The interactions of salinity, temperature, and ionizing radiation as environmental factors affecting mortality, LD-50 (lethal dose for 50% mortality), and sodium-22 efflux of the euryhaline fish, Fundulus heteroclitus, were determined in a series of experiments. Multiple regression analyses were used to derive equations describing effects of all factors that significantly influenced mortality of the fish at three different intervals after irradiation. Temperature effects were significant at all three intervals, and effects of salinity, radiation dose, and temperature-salinity interaction were each significant at one or more of the different times after irradiation. Various combinations of different levels of temperature and salinity yielded different LD-50 values. At the upper end of their temperature range, fish tolerated more radiation at low salinity. At the lower end of their temperature range, this tolerance was reversed. Irradiated fish generally lost sodium-22 more rapidly than unirradiated fish, suggesting that lethal effects of radiation may stem from damage to osmoregulatory capabilities. Gills being vital in regulation of salt and water balance, damage to them could explain inability of irradiated fish to exist at certain temperature-salinity combinations. (See also Vol 2, No 18, Field 5C, W69-07441). (Jones-Wis)
W69-08681

IMPLICATIONS OF RADIOECOLOGY FOR OTHER RESEARCH IN ENVIRONMENTAL CONTAMINATION,
North Carolina State Univ., Raleigh. Inst. of Statistics.
Don W. Hayne.
Proc 2nd Natl Symp on Radioecology, May 15-17, 1967, Ann Arbor, Mich. US Atomic Energy Comm, Doc CONF 670503, p 32-38. Available from Clearinghouse for Federal Sci and Tech Information as CONF 670503.

Descriptors: *Radioecology, *Environmental sanitation, Dynamics, Food chains, Hazards, Fallout, Genetics, Tracers, Pesticides, Damages, Growth rates, Reproduction, Resistance, Carnivores, Trophic level, Domestic animals, Toxicity, Mammals, Birds, Population, Plants, Human population, Biota, DDT, North Carolina, Sampling, Monitoring, Distribution, Kinetics, Lipids, Mathematical models.

Identifiers: *Contamination, *Pollution, Cycling, Survival, Peromyscus, Patuxent Wildlife Research Center, Radionuclides, Biological magnification.

Radioecology has advanced understanding of what happens to material, natural or unnatural, introduced into the biological world and of unfavorable effects of long-term exposure at low levels. Distribution and occurrence of contaminants in food, water supplies, and gross aerial pollution must be studied and an attempt made to sample the world. Also needed is information bearing on kinetics of contamination including all processes whereby materials move within ecosystems, whether between cells of an organism, among organs and physiological pools of organisms, through food chains, or whether transported globally by physical means. In this regard, retention of DDT lipids of the body, apparently under conditions of dynamic interchange is illustrative. Author presents mathematical model for concentration in lipids. Another area for attention is individuals' response to toxicants. There is need of standardized tests of chronic effects on important biological parameters of growth, reproduction, survival, and behavior. Effects of radiation on populations also need study. Strongest argument for laboratory investigation of individual response is the possibility of predicting effects expressed as body burdens or storage concentrations. When field observations can demonstrate such concentrations, interpretation of effects can be made. (See also Vol 2, No 18, Field 5C, W69-07441). (Jones-Wis)
W69-08682

THE SCIENTIST'S RESPONSIBILITY IN THE CONTROL OF MAN'S ENVIRONMENT,
Chet Holifield.
Proc 2nd Natl Symp on Radioecology, May 15-17, 1967, Ann Arbor, Mich. US Atomic Energy Comm, Doc CONF 670503, p 1-8. Available from Clearinghouse for Federal Sci and Tech Information as CONF670503.

Descriptors: *Environment, Pollutants, Nuclear powerplants, Ecology, Fallout, Nuclear explosions, Uranium radioisotopes, Mining, Public health, Effluents, Generators, Water pollution, Costs, Energy, Radioactive wastes, Radioactive waste disposal.
Identifiers: *Scientist's responsibility, Peaceful applications, AEC National Laboratories.

Author discusses ecological issues, especially effects of nuclear explosives on ecosystems from Panama Canal to northern coasts of Alaska and effects of fallout--the Eskimo's problem of body burden accumulations via food chain. Peaceful applications of nuclear explosives demand consultation with ecologist. Uranium miners' exposure to radiation still requires solution. Citizens' revolt against pollution of their environmental demands corrective action. Data affecting health and welfare must be obtained. Remedial action is being slowly instigated. Administrators using results of research must use them properly as improper impressions or conclusions may lead to unsuitable decisions by laymen. Use of nuclear energy may reduce pollution since effluents can be controlled in large measure. Low cost energy from nuclear power plants can be used to purify and reclaim water supplies. Given this clean energy in abundance, railroads could be electrified, sewage pasteurized, cities centrally heated and refrigerated, and almost every urban service fulfilled without pollution. Energy should be considered more in urban planning, even the location of reactors in the heart of cities. Although quantities of nuclear waste would have to be stored, techniques are now being refined for disposal, including storage in salt mines. (See also Vol 2, No 18, Field 5C, W69-07441). (Jones-Wis)
W69-08683

RADIOECOLOGY AND THE FEASIBILITY OF NUCLEAR CANAL EXCAVATION,
Battelle Memorial Inst., Columbus, Ohio. Columbus Labs.
William E. Martin.
Proc 2nd Natl Symp on Radioecology, May 15-17, Ann Arbor, Mich. US Atomic Energy Comm, Doc CONF 670503, p 9-22. 3 fig, 2 ref. Available from Clearinghouse for Federal Sci and Tech Information as CONF 670503.

Descriptors: *Radioecology, *Nuclear engineering, *Canal construction, Ohio, Agriculture, Forests, Fresh water, Ecology, Marine animals, Marine plants, Fallout, Food chains, Hazards, Panama Canal, Atlantic Ocean, Pacific Ocean, Topography, Geologic formations, Hydrology, Hydrography, Biota, Environment, Diseases, Fish, Estuaries, Gamma rays, Tritium, Strontium radioisotopes, Manganese, Calcium, Phosphorus radioisotopes, Iron, Iodine radioisotopes, Cesium, Lead radioisotopes, Soils, Spectrometers, Magnesium, Aluminum, Sodium, Nitrogen, Molybdenum, Cobalt, Sulfur, Carbon, Radiochemical analysis, Rice, Shrimp, Mollusks, Mangrove swamps, Mathematical models.
Identifiers: Columbus (Ohio), Central America, Colombia, External dosimetry, Internal dosimetry, US Atomic Energy Comm, Scandium-46, Ruthenium-106, Cerium-144, Wolfram-181, Plutonium-239, Radionuclide concentration, Zinc, Ecuadorian Institute of Anthropology and Geography, Anthropology, Cavanillesia plantanifolia, Prioria copaifera, Biogeochemistry.

Bioenvironmental and other studies are in progress to evaluate feasibility, from viewpoint of radiological safety, of plans for nuclear excavation of a sea-level canal across the isthmus of Central America. In order to predict external and internal radiation doses to human populations near proposed canal routes, field studies of human, agricultural, forest, freshwater, and marine ecology, have been undertaken in eastern Panama and northwestern Colombia. Results of these studies will be combined with predictions of radionuclide production and initial fallout distribution, for estimating radionuclide transfer through tropical food chains and other environmental pathways leading to man. Estimates will be made of types and quantities of radionuclides to be expected, during and after nuclear excavation, in the external environments and diets of native populations in different parts of two study areas, with calculations of potential radiation doses to man based on these estimates. Due to the nature of the problem, it has been necessary to make broad ecological studies of a fundamental nature. This paper reviews these studies and demonstrates that assessment of potential radiological hazards is dependent upon accumulation of ecological and biogeochemical data and application of radioecological principles. (See also Vol 2, No 18, Field 5C, W69-07441). (Jones-Wis)
W69-08684

PESTICIDES AND POLLUTION,
Bureau of National Affairs, Inc., Washington, D.C.
Sandra C. Bloom, and Stanley E. Degler.
Bur Nat Affairs Environ Manage Ser Rep, 1969. 99 p, 3 tab.

Descriptors: *Pesticides, *Pollution abatement, *Regulation, *Legislation, State governments, Federal government, Toxicity, Pesticide residues, Fishkill, Hazards, Pesticide toxicity, Public health.
Identifiers: Pesticide regulation, Pesticide laws.

Pesticide uses, effects, damages, regulation, and legislation are surveyed. Organizations studying and monitoring pesticides are listed and their work is reviewed. Federal and State regulation and registration of users and producers is discussed. The federal pesticide act of 1947 (amended 1959, 1961, and 1964), a proposed uniform state pesticide act, and regulations under these laws as adopted by the Association of American Pesticide Control Officers are presented. Other legislation is proposed for custom pesticides application. (Knapp-USGS)
W69-08707

OIL POLLUTION: PROBLEMS AND POLICIES,
For primary bibliographic entry see Field 05B.
W69-08752

BEHAVIOR OF ORGANIC CHEMICALS THE AQUATIC ENVIRONMENT. PART BEHAVIOR IN DILUTE SYSTEMS,
Washington Univ., St. Louis, Mo. Environm and Sanitation Engineering Lab.
J. C. Buzzell, Jr., R. H. F. Young, and D. W. Ryckman.
Manufacturing Chem Ass Res Rep, Apr 1968. 37 fig, 9 tab, 31 ref.

Descriptors: *Water chemistry, *Organic pounds, *Biodegradation, *Chemical degrada Oxygen demand, Water pollution effects, Bac Toxicity, Fish, Pesticides, Aqueous solut Nitrates, Aquatic microorganisms.
Identifiers: Organic chemical behavior in wate

A research study of the behavoir of organic ch cals in the aquatic environment, was made of d systems as found typically in lakes and deep ri A standardized method is described for evalu and predicting the behavior of organic chemic this environment. The method was tested wit selected organic chemicals and was found to b liable and reproducible. It is applicable to s compounds, mixtures, and total waste stre yielding more meaningful results than can be tained with the Biochemical Oxygen Deman day BOD) test. When used with sound judg and engineering experience, results obtained this method should serve as reliable guide to not an absolute prediction of, the behavior o ganic chemicals under field conditions. In 19 literature critique was published on this su under the authorship of D. W. Ryckman, A. Prabhakara Rao, and J. C. Buzzell, Jr., which tains 597 references. (Lang-USGS)
W69-08767

HEALTH.
For primary bibliographic entry see Field 06E.
W69-08791

HEALTH.
For primary bibliographic entry see Field 06E.
W69-08792

PESTICIDES: PRESENT AND FUTURE.

Chem Eng, p 133-140, Apr 1969. 8 p, 4 fig, 3 t

Descriptors: *Pesticides, Pesticide residues, cide toxicity, DDT, Selectivity, Insect attract *Insecticides, *Herbicides, Pollut *Chlorinated hydrocarbon pesticides, *Carba pesticides, Formulation, *Organophosphorus cides, Toxicity, Contamination, *Urea pestic Environmental effects, Hazards, Biocontrol, control.
Identifiers: Biological magnification.

The advantages and dangers inherent in pesti depend upon toxicity. Pesticide toxicity residue problems are reviewed. Fundam requirements for safer and more effective cides are selective toxicity, ease of application low cost. The production and consumption of cides are discussed; the manufacture of some cessful pesticides is described, including Sevin, Vapona, Parathion, and several herbic Formulation and safety precautions are cov New products and new approaches are const being sought for existing pesticides that have vantages such as erratic selectivity, residue dup, or food contamination. Biological cont showing promise for insect control, and ha vantages over artificial agents in avoiding specificity and toxicity problems. (USBR)
W69-08843

EFFECTS OF WASTE EFFLUENTS ON PLASTICITY OF EARTH MATERIALS,
Illinois State Geological Survey, Urbana.
William Arthur White, and M. Katherine Kyri

l Surv Environ Geol Note No 23, July 1968. fig, 6 tab, 15 ref.

ptors: *Soil disposal fields, *Soil mechanics, anical properties, *Physical properties, *Ex- e clays, Clays, Plasticity, Soil engineering, lations, Soil strength.
fiers: Effluent effects (Clays).

ffects of waste effluents on the pasticity and th of some earth materials was evaluated. se earth materials must support engineering ures such as buildings, dams, and roads, th changes are potentially dangerous. The Il- State Geological Survey investigated the ef- f soap, detergent, water softener, starch, and softener on 5 natural clays. The effects of the es on plastic limit, liquid limit, and plasticity are tabulated. In areas with montmorillonite, nts may increase swelling by exchanging their n for the clay's calcium. Some anionic deter- may increase evaporation rates, which can be tageous in soil disposal systems. (Knapp-)
08955

SUBMERGED AQUATICS OF UNIVERSI- AY: A STUDY IN EUTROPHICATION,
nsin Univ., Madison.
Lind, and G. Cottam.
ican Midland Naturalist, Vol 81, No 2, April p 353-369, 4 fig, 6 tab, 16 ref. OWRR Pro- -019-Wis.

iptors: *Submerged plants, *Aquatic plants, ur mapping, Eutrophication, Wisconsin.
fiers: *Plant communities, University Bay, Mendota, Wisconsin, Quantitative composi- Myrophyllum exalbescens.

ubmerged aquatic plants of University Bay, Mendota, Dane County, Wisconsin, were ed using the line intercept method. Twenty- nes, perpendicular to the shoreline and ex- g into the bay to the depth at which growth merged aquatic plants ceased were sampled. lants intercepting the line were recorded consecutive half-meter segments of the line. ata were used to construct a contour map of getated portions of the bay and to delimit the communities. Six plant communities were Data on plant height and standing crop were ied from quadrat samples taken at biweekly als from four regions within the bay. The data compared with studies made in 1922. Marked es in quantitative composition have occurred 1922, with the most marked difference being eat increase in Myriophyllum exalbescens ie complete disappearance of several species were formerly major components of the tion. (Lind-Wis)
09010

ADSORPTION AND DEGRADATION OF TICIDES BY LAKE SEDIMENTS,
nsin Univ., Madison.
Newland.
of Wisconsin Water Resources Center Re- 968. 92 p. OWRR Project B-016-Wis.

ptors: *Insecticides, Sediments, Adsorption, dation, Pesticides, Public health.
iers: *Lake sediments, *Gamma-BHC, hion, Environmental pollution.

sed usage of insecticides has led to the accu- on of residues in the environment, thus g a potential health hazard for fish, wildlife, mans. The problem is especially acute in stems as it leads to the possible pollution of g water supplies. All of these factors have itated the evaluation of the persistence and insecticides in the environment. In spite of ct that pesticidal pollution of natural es has been studied over a decade many of the problem are still unexplained, e.g., the rm effect of pesticides on the quality and ity of water resources. There are principally three ways by which a pesticide may reach the aquatic environment: (1) runoff from land amended with pesticides, (2) direct application or drift from adjacent spraying, and (3) recharge from contaminated aquifers. After introduction of the pollutant (pesticide) in the environment, its fate is then governed by the physical and chemical characteristics of the compound. If the pesticide remains in true solution, it can remain intact or can be degraded chemically and/or biologically. However, if the compound is adsorbed by the sediment, the pesticide may be detoxified by rendering it unavailable or its rate of degradation may be changed considerably. If the electronic configuration of the molecule is changed by adsorption the rate of degradation of the pesticide is likely to be increased. Conversely, if adsorption results in localization of the pesticide in places inacessable to agencies responsible for its degradation, the rate of degradation may be greatly curtailed. The experiments described in this thesis were initiated to determine the rates and pathways of gamma-BHC and parathion degradation in artificial lake systems. (Author)
W69-09011

ADSORPTION AND DESORPTION OF INORGANIC PHOSPHORUS BY LAKE SEDIMENTS IN A 0.1 MOLAR SODIUM CHLORIDE SYSTEM,
Wisconsin Univ., Madison.
J. D. H. Williams, J. K. Syers, R. F. Harris, and D. E. Armstrong.
Univ of Wisconsin Water Resources Center Report, June 1969, 17p. OWRR Proj B-022-Wis.

Descriptors: *Phosphorus, Sediments, Lake soils, Calcareous soils, Adsorption.
Identifiers: *Lake sediments, *0.1 Molar sodium chloride system, Non-calcareous soils.

Non-calcareous lake sediments generally adsorbed and retained more added inorganic phosphorus than calcareous lake sediments. Sediments which retained the most added phosphorus during adsorption tended to release the least phosphorus during a subsequent desorption at all levels of added phosphorus. The net amount of added phosphorus adsorbed (following adsorption and desorption) was lowest for calcareous sediments, with one exception, at the highest level of added phosphorus (50 micrograms phosphorus/milliliter). The reactions involved in the adsorption and desorption of added phosphorus were not always completely reversible during the time-periods used in the experiment. A close relationship was found between the order of the capacity of a sediment to retain added phosphorus in the laboratory and the levels of native total phosphorus and inorganic phosphorus in the sediment. (Williams-Wis)
W69-09014

FRACTIONATION OF INORGANIC PHOSPHORUS IN LAKE SEDIMENTS: I. RELEASE AND RESORPTION OF PHOSPHORUS DURING FRACTIONATION,
Wisconsin Univ., Madison.
J. D. H. Williams, J. K. Syers, D. E. Armstrong, R. F. Harris, and D. E. Spyridakis.
Univ of Wisconsin Water Resources Center Report, June 1969, 12p. OWRR Proj B-022-Wis.

Descriptors: *Phosphorus, *Distillation, *Wisconsin sediments, Calcareous-soils.
Identifiers: *Inorganic phosphorus fractionation process, *Lake sediments, Southern Wisconsin, Non-calcareous sediments, Resorption.

Procedures for characterizing the forms of inorganic phosphorus in lake sediments are discussed. Sediments were treated with an ammonium reagent containing added inorganic phosphorus to determine the recovery of phosphorus in this and subsequent stages of an inorganic phosphorus fractionation procedure. Total recovery of added phosphorus was 95 plus or minus 8 percent for nine calcareous sediments from southern Wisconsin. All of the phosphorus added to the non-calcareous sediments was recovered in the ammonium and succeeding first sodium hydroxide extracts. In the case of the calcareous sediments added phosphorus was recovered in the first hydrochloric acid, citrate-dithionite-bicarbonate, ammonium sub four fluoride, and second hydrochloric acid extracts, in declining order of importance. Recovery of added phosphorus in several extracts indicates that the interpretation of fractionation results is seriously complicated unless resorption of phosphorus released from the sediment during the extraction is corrected. Resorption can be largely corrected for when fractionating the inorganic phosphorus of non-calcareous but not of calcareous sediments. Little influence of state of sample on percentage recovery values was detected. (Williams-Wis)
W69-09019

FRACTIONATION OF INORGANIC PHOSPHORUS IN LAKE SEDIMENTS: II. FORMS AND AMOUNTS OF INORGANIC PHOSPHORUS,
Wisconsin Univ., Madison.
J. D. H. Williams, J. K. Syers, D. E. Armstrong, R. F. Harris, and D. E. Spyridakis.
Univ of Wisconsin Water Resources Center Report, June 1969, 11 p. OWRR Proj B-022-Wis.

Descriptors: *Phosphorus compounds, *Wisconsin, *Distillation, Phosphorus, Sediments, Calcareous soils.
Identifiers: *Lake sediments, Southern Wisconsin, Non-calcareous sediments.

The forms and amounts of inorganic phosphorus in five non-calcareous and nine calcareous Wisconsin lake sediments were determined using a recently developed fractionation scheme. Total phosphorus ranged from five hundred and eighty to six thousand and ninety parts per million and was usually lower in the calcareous sediments. The proportion of acid-extractable calcium phosphate was higher in the calcareous sediments; with one exception, this fraction constituted eight percent or less of total inorg. phosphorus in the non-calcareous sediments. Only for the calcareous Lake Wingra sediments did easily-soluble phosphorus (ammonium sub four chloride phosphate) exceed five percent of total inorg. phosphorus. The ammonium sub four fluoride phosphate and first sodium hydroxide phosphate fractions were low in the Wingra samples but constituted a higher proportion of total inorg. phosphorus in the others. Over eighty percent of total inorg. phosphorus in two non-calcareous sediments, which were highest in total phosphorus, was present in the first sodium hydroxide extraction. Low values for reductant-soluble phosphorus were obtained for the non-calcareous sediments; the higher values for this fraction in calcareous sediments are thought to be due to the release of inorganic phosphorus adsorbed by carbonate matrices. The second sodium hydroxide phosphate and residual inorg. phosphorus fractions were low in all samples. Values for ammonium sub four fluoride phosphate in the calcareous sediments were affected by state of sample (undried, freeze dried, and air dried). The sum of ammonium sub four fluoride phosphate plus first sodium hydroxide phosphate was independent of sample state and the values for ammonium sub four fluoride phosphate were affected appreciably by sample pretreatment for non-calcareous samples only. Reductant-soluble phosphorus values were influenced by state of sample in some cases. (Williams-Wis)
W69-09020

5D. Waste Treatment Processes

PRACTICAL APPLICATION OF FOAM FRACTIONATION TREATMENT OF LOW QUALITY WATER,
Alaska Univ., College. Inst. of Water Resources.
For primary bibliographic entry see Field 03C.
W69-08690

THE COURSE OF SELF-PURIFICATION PROCESS OF CANALIZED, HIGHLY POLLUTED RIVERS,
For primary bibliographic entry see Field 02K.
W69-08703

DILUTE SOLUTION REACTIONS OF THE NITRATE ION AS APPLIED TO WATER RECLAMATION,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Cincinnati Water Research Lab.
Frank C. Gunderloy, Jr., Cliff Y. Fujikawa, V. H. Dayan, and S. Gird.
Robert A. Taft Water Res Center Rep No TWRC-1, Oct 1968. 67 p, 14 tab, 232 ref, append.

Descriptors: *Denitrification, *Water chemistry, *Sewage treatment, *Chemical degradation, Nitrates, Ammonia, Reduction (Chemical), Oxidation, Phosphates, Iron compounds, Sulfates, Catalysts, Copper compounds.
Identifiers: Inorganic denitrification.

A new and unexpected partial denitrification of dilute nitrate ion solutions (10 to 50 ppm) was achieved by treatment with 8 moles of ferrous sulfate per mole of nitrate in unbuffered alkaline reactions. The nitrogen loss, which probably represents evolution of nitrogen or nitrous oxide was as high as 50%. Total reduction to lost nitrogen plus nitrate and/or ammonia approached 100%. The reduction takes place in the presence of partially oxidized black iron hydroxides, and requires catalytic quantities of cupric ion. Denitrification is suppressed by phosphates, as well as by several other factors, some as yet unidentified. Silver ion catalysis or a 16-fold excess of the ferrous salt permits reduction to ammonia in the presence of phosphate, but there is no accompanying denitrification. (Knapp-USGS)
W69-08715

POLLUTION CHARGES, WASTE ASSIMILATIVE CAPACITY INVESTMENT, AND WATER QUALITY: THE PUBLIC COSTS OF A PUBLIC GOOD,
Ohio State Univ., Columbus. Dept. of Economics.
For primary bibliographic entry see Field 06C.
W69-08751

SOME ASPECTS OF WATER SUPPLY AND SEWERAGE IN ROMANIA (ROMANIAN),
State Water Committee, Bucharest (Rumania).
Ion Teodorescu.
Hidrotehnica, Gosp Apelor, Meteorol, Vol 13, No 6, p 269-272, June 1968. 4 p.

Descriptors: *Water supply, *Water resources development, *Water resources, *Water quality control, Waste water treatment, Water demand, Water pollution control, Water treatment, Sewage treatment, Sewers, Analytical techniques, Filtration, Coagulation.
Identifiers: *Romania.

The water needs for industry, agriculture and domestic uses in Romania are expected to show a great increase in the future. Examples of recent plans of water resources and development in the country are briefly discussed. Flood control, construction of new lakes and reservoirs, development of new methods for controlling the water quality, control of pollution, and construction of waste treatment plants are only some of the problems which get more and more attention in Romania. Water filtration, decantation, and coagulation, uses of new technological processes, etc., are part of a new and coordinated research and development program. The waste treatment plants need to be modernized and staffed with highly qualified personnel. There is also an obvious need for development of new waste treatment plants and for a better geographical distribution in accordance with industrial and population growth. Above all, water quality and not quantity seems to be the control problem which requires adequate solutions from hydrologists. (Carstea-USGS)
W69-08962

5E. Ultimate Disposal of Wastes

COMMONWEALTH V SONNEBORN (INDUSTRIAL POLLUTION).
For primary bibliographic entry see Field 06E.
W69-08778

5F. Water Treatment and Quality Alteration

STRUCTURE AND VALUES IN LOCAL POLITICAL SYSTEMS: THE CASE OF FLUORIDATION DECISION,
Chicago Univ., Ill.; and State Univ. of New York, Buffalo.
Robert L. Crain, and Donald B. Rosenthal.
(National Opinion Research Center reprint, University of Chicago) Journal of Politics, Vol 28, No 1, Feb 1966. p 169-195.

Descriptors: *Local governments, *Fluoridation, Decision-making, Surveys, Social values.
Identifiers: Community structure.

Previous studies of fluoridation controversies have been limited to analysis of only one city or at most a small number of cities. The research reported here was designed to complement these earlier studies with an analysis which was: (1) frankly political in approach, and (2) based on a large number of cases. Questionnaires were mailed to the local public health officer, the city clerk, and the publisher of the largest newspaper in each of 1,186 cities; 1,051 of these were cities between 10,000 and 500,000 population which (a) did not have fluoride naturally present and (b) were the primary consumers of their water supply. (This excludes many suburbs.) The remaining 75 cities were cities between 5,000 and 10,000 population which had held referenda. From the responses to the questionnaires, it was concluded that fluoridation has the following political properties: (1) it has almost unanimous support among the elite; (2) very few members of the elite have a strong interest in seeing it adopted; (3) the opposition comes from an organized minority, usually including chiropractors, Christian Scientist, natural food faddists, and, in a few cases, the radical right; (4) the public at large is uninformed but is cautious because of the possible side effects of any medical innovation; and, (5) the medical profession is virtually unanimous in support of fluoridation. While each of these statements requires a slight qualification, the general implications seem clear. Fluoridation can be adopted only by cities in which the political and civic elites' mild support is sufficient to offset the virulent opposition of a minority or ordinary citizens, and only when it is possible to keep bounds on the level of public discussion so that the argument does not escalate into a confused debate involving large numbers of the general public. (Fortinsky-Chicago)
W69-08889

EXECUTIVE LEADERSHIP AND COMMUNITY INNOVATION: THE FLUORIDATION EXPERIENCE,
State Univ. of New York, Buffalo; and Chicago Univ., Ill.
For primary bibliographic entry see Field 06E.
W69-08891

POLICIES FOR EFFECTIVE AND ECONOMIC CONTROL OF THE ENVIRONMENT,
Wisconsin Univ., Madison.
I. K. Fox.
Paper presented at the Executive Management Seminar, Washington, D.C., February 7-9, 1969. 22 p.

Descriptors: *Community development, Waste disposal, Planning, Environmental effects, Municipal wastes, Industrial wastes, Rural areas, Preservation.
Identifiers: *Environmental contamination, *Waste management, *Economic control.

This paper is concerned with the physic
biological environment of man and the infl
of waste disposal practices, incidental cont
tion and development upon this environme
vironmental problems arise because
economic activities impose costs or damag
others, many of the effects are difficult to m
in quantitative terms, and numerous uncert
exist as to the nature and significance of so
vironmental effects. Environmental problen
be effectively studied in accord with the fol
classification of situations: (a) wastes and co
nants in urban-industrial areas; (b) patte
urban design; (c) the effects of contaminan
wastes on the biological environment; (d) de
tion of unique natural areas; (e) deteriorat
the countryside. Six policy directions ar
gested: (1) Foster regional systems for ma
wastes and contaminants; (2) Develop eco
incentives which encourage environmental p
vation; (3) Prohibit use of contaminants havi
certain long range consequences; (4) Ration
unique environmental areas; (5) Enlarge eff
preserve the rural countryside; (6) Make
provision for representing the general pub
decisions relating to the environment. (Autho
W69-09023

5G. Water Quality Control

OBSERVATIONS AND EXPERIENCES IN
CONTROL OF ALGAE,
Terrence P. Frost.
J New Hampshire Water Works Assoc, 10 p
1963. 1 tab, 12 ref.

Descriptors: *Nuisance algae, *Algal co
*New Hampshire, *Copper sulfate, Sewa
fluents, Smelts, Fishkill, Crustaceans, Botton
ments.
Identifiers: *New Hampshire Water Pol
Commission, Algal blooms, Nutrient
Synthetic detergents, Fish managers, Fish
Underwater shock wave, Anabaena, Phygo
(Dichlone), New Hampshire, Lake Winnis
Long Pond, Concord, Boston Lot Res
Lebanon, Wadleigh State Park, Lake Shatu
Mascoma Lake, Glen Lake.

Author offers various observations and exper
related to algal control operations in nutrie
waters by the New Hampshire Water Pol
Commission. Since 1961, about 6,000 acres/y
Lake Winnisquam and others have been tr
Overenrichment of the lakes is due to eff
from municipal and industrial treatment plan
equipped to strip nutrients because of inc
operational costs. In controlling algae with c
sulfate, the Commission has encountered sor
position from fish managers wary of its effe
fish populations. Tests run on adult smelt an
showed levels applied in algal control we
lethal to fish and may in fact increase fish yi
some lakes. A side effect of copper sulfating
increased crustacean population which is
pressed by large algal communities. So far i
Hampshire, sampling of bottom muds has sho
accumulations of copper exceeding the lev
untreated lakes. Author mentions many suc
projects and only one catastrophe, a massiv
kill in Boston Lot Reservoir, resulting fr
miscalculation of volume and doubling d
copper sulfate. The Commission plans to e
ment with copper sulfating in the future for p
tive control. (Ketelle-Wis)
W69-08674

SOME LEGAL AND ECONOMIC IMP
TIONS OF SEA WATER INTRUSION--A
STUDY OF GROUND WATER MANAGEM
California Univ., Davis. Dept. of Agric
Economics; and California Univ., Davis.
Resources Center.
For primary bibliographic entry see Field 02I
W69-08768

R SALINITY PROBLEMS: APPROACHES GAL AND ENGINEERING SOLUTIONS,
ley, Hufstedler and Kemble, Los Angeles, and Colorado River Board of California, Los s.
mary bibliographic entry see Field 02K.
8769

R POLLUTION (POWERS OF COMMIS- N RELATION TO POLLUTION).
mary bibliographic entry see Field 06E.
8797

R POLLUTION CONTROL AUTHORITY- S AND REGULATIONS.
mary bibliographic entry see Field 06E.
8806

REHENSIVE WATER POLLUTION CON- PROGRAM.

n Code art 96A:75-79 (Supp 1968).

ptors: *Maryland, *Water pollution control, ion abatement, *Administrative agencies, pollution treatment, Legislation, Programs, governments, Local governments, Sewage ent, Silt, Acid mine water, Agricultural als, Industrial wastes, Water quality, Water control, Interstate compacts, Manpower, nel, Training, Technology, Surveys, Data sing, Programs, Legal aspects.

rt of the Comprehensive Water Pollution l Program, the State Health Department and partment of Water Resources shall submit a to the governor on water quality monitoring, rocessing and laboratory services needed to ollution control needs. The Department of Resources shall recommend measures to l pollution from silt, acid mine draining, lture drainage and industrial waste. The de- nts shall submit an annual report to the or and general assembly on: (1) the status of water supply and sewerage plans; (2) the of water quality standards programs; (3) the of interstate compacts; (4) the status of stu- d programs under this subtitle; (5) related l plans; (6) other state programs. The depart- may cooperate with the appropriate agencies training of technical personnel for water on control. The departments may conduct , surveys, investigations, research and s and may engage consultants to accomplish pose of this subtitle. (Helwig-Fla)
8863

ECONOMICS OF REGIONAL WATER ITY MANAGEMENT,
ces for the Future, Inc., Washington, D.C.
Kneese.
re, Johns Hopkins Press, 1964. 215 p.

ptors: *Waste disposal, *Water resources, benefit analysis, *Cost allocation, Econo- f scale, Effluents, Groundwater, Hydrologic , Industrial water, Irrigation, Cities, g, Pollution, Public health, Water courses, Riparian rights, Streamflow, Reservoirs.
ers: *Ruhr region of West Germany, *Ohio Cost minimization, Land use planning.

ok is designed to shed light on how to deter- economically optimal region systems for ng water quality and how to devise ap- te institutional forms and tools for manage- f water quality. To achieve this purpose, e economic theory of resources allocation se studies of actual situations are used. An ction to the scientific and technological of water quality is included, followed by the cation of major waste materials entering urses and methods of treating both waste and water supplies. Following this discus- an outline of the economic resources alloca- tion theory as related specifically to waste disposal problems, and especially that of water pollution. The criteria of cost assessment and redistribution are applied to the water quality problem in the Ohio Basin. Regional waste disposal systems are then discussed as water quality control systems which are part of general water resources management and must be planned accordingly. The Ruhr area of West Germany is studied in this respect, previous to a survey of the implications of this area on present and future policy-making. (Murphy-Rutgers)
W69-08981

FEDERAL AID FOR WATER POLLUTION CONTROL.

Md Ann Code art 43, sec 617 (1965), as amended, (Supp 1968).

Descriptors: *Maryland, *Water pollution, *Water pollution control, *Federal government, Public health, Pollution abatement, Treatment facilities, Wastes, Sewage, Water pollution treatment, Legislation, Cost sharing, Grants, Costs, Financing, Construction, Legal aspects, Construction costs.
Identifiers: *Federal Water Pollution Control Act.

The State Board of Health is designated as the State Water Pollution Control Agency. The Board is vested with the authority to comply with the federal government under the Federal Water Pollution Control Act. This act provides grants to the states to assist them in meeting the cost of establishing and maintaining adequate measures for the prevention and control of water pollution, including grants for the construction of treatment works to prevent the discharge of untreated or inadequately treated sewage or other waste into the waters of the state. No other state agency may exercise the powers hereby vested in the State Board of Health. (Shevin-Fla)
W69-09013

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

OPTIMIZING CONJUNCTIVE USE OF GROUNDWATER AND SURFACE WATER,
Utah State Univ., Logan. Dept. of Civil Engineering.
James H. Milligan.
Utah State Univ Water Res Lab Rep, June 1969. 157 p, 19 fig, 19 tab, 60 ref, append. OWRR Proj No B-013-UTAH.

Descriptors: *Systems analysis, *Conjunctive use, *Surface waters, *Groundwater, *Utah, Mathematical models, Linear programming, Optimization, Stochastic processes, Probability, Planning, Water management (Applied), Water resources development, Computer programs.
Identifiers: *Conjunctive use optimization.

Mathematical models for groundwater and surface-water systems are formulated and solved on a digital computer using linear programming for optimizing the water use of the system. Post-optimal analysis, including sensitivity analysis of the objective function coefficients and right-hand side terms, is also applied to the models. The models which are developed include a general deterministic model, a general stochastic model in which hydrologic inputs are allowed to be probabilistic, and models of two simple, but real, river basins. The advantages of linear programming analysis are demonstrated by the computer solutions which can be obtained by this method of optimization. The method is shown to be effective as a guide to optimal water resources systems design and planning. (Knapp-USGS)
W69-08742

URBAN WATER RESOURCES RESEARCH,
American Society of Civil Engineers, New York. Urban Hydrology Research Council.
For primary bibliographic entry see Field 04C.
W69-08743

WATER RESOURCE ECONOMICS RESEARCH IN THE SOUTHEAST,
Economic Research Service, Washington, D.C.
George A. Pavelis.
Institute of Food and Agricultural Sciences, The University of Florida, Pub No 3, p 89-104, Dec 1967. 16 p, 1 tab, 13 ref.

Descriptors: *Resource development, Programs, Systems analysis.
Identifiers: *Southeast U.S.

First, water resources economics and economic research is placed in a logical context to indicate the dimensions of the problem. Next, some national research programming efforts to direct public and scientific attention to water resource questions are examined. Finally, some observations are made of how the subject of research needs in the Southeast can itself be treated as an economic problem. (Grossman-Rutgers)
W69-08966

WATER RESOURCES SYSTEMS ANALYSIS,
North Carolina Univ., Chapel Hill. Natural Resources and Planning.
Maynard M. Hufschmidt.
Dept of Environ Sci and Eng, Pub No 138, Nov 22, 1966. 11 p, 1 tab, 11 ref.

Descriptors: *Systems analysis, Planning, River basin development.
Identifiers: *Sub-systems, *Typology.

The notion of comprehensive multi-purpose river basin planning implies a systems approach. A subsystem is a set of functionally related elements which can feasibly be analyzed as an entity, and which can be tied effectively to a larger system by means of well-defined links. Two broad classes of sub-systems are (1) physical-technologic, and (2) social-economic. A typology of sub-systems for water resources is developed. A listing of bibliographical references is included. (Grossman-Rutgers)
W69-08968

THE IDENTIFICATION PROBLEM AND THE VALIDITY OF ECONOMIC MODELS,
Simon Fraser Univ., Burnaby (British Columbia).
L. A. Boland.
South African Journal of Economics, Vol 36, No 3, p 236-240, Sept 1968. 5 p.

Descriptors: *Model studies, *Planning, Mathematical model, Economics, Costs, Benefits.
Identifiers: *Identification problem, Model validity, Model construction, Stochastic models, Exogenous variable, Endogenous variable.

The article is concerned with the benefits and costs of a particular aspect of the decision concerning the construction of an economic model. The author feels most econometricians implicitly ascribe to the conventionalist theory of knowledge, i.e., truth is only a matter of convention. He cites as proof of this the concern shown towards the problem of identification. The epistemological problem pertaining to the validity of the model is logically prior to the problem of identification. The solution to the identification problem amounts to the avoidance of a solution which remains invarient under transformations of the co-ordinates. The author thus concludes that the uniqueness property of identification implies a lack of invariance. Due to the importance of econometric analysis and econometric models in water resource planning and analysis this article should prove useful to empirical researchers in the water area. (Murphy-Rutgers)
W69-08976

OPTIMAL MATHEMATICAL MODELS IN PLANNING THE DEVELOPMENT OF A BRANCH AND IN TECHNICAL POLICY,
L. Kantorovich.
Problems of Economics, Vol 11, No 3, p 3-16, Jul 1968. 14 p.

Descriptors: *Mathematical models, Planning, Linear programming, Resources, Model studies, Depreciation, Demand, Prices.
Identifiers: *Branch models, *Branch management, Development, Technical policy, Optimal models, Nonlinearities, Indivisibilities, Multiproduct models, Output, Indices.

The return to the branch management of industry and its elevation to a new level create conditions favorable to the scientifically substantiated resolution of the problem of branch development. In this area, considerable use must be made of mathematical methods and models as well as the analysis and calculations based on them. At the present time widespread use is being made of the simplest optimal models of the development and location of branches; models calculated by linear programming methods and which in many cases are resolved on the basis of algorithms. The basic advantage of these models over the traditional system of isolated economic analysis for individual enterprises and of the balancing of production and demand is the complex approach in which there is a simultaneous joint analysis of the nation's total demand and of the production potentialities of all enterprises in a branch (existing and projected). This makes it possible to achieve an optimal combination of the interests of producers and consumers. These models can be applied to day-to-day planning of economic policy and management in the water resource area. (Loeb-Rutgers)
W69-08986

6B. Evaluation Process

WATER AND METROPOLITAN MAN, AN ENGINEERING FOUNDATION RESEARCH CONFERENCE,
William Whipple, Jr.
In Water and Metropolitan Man, An Engineering Foundation Research Conference, ASCE Urban Hydrology Research Council Summary, p 11-14, 1968.

Descriptors: *Social impact, Systems analysis, *Social needs, *Social values, Urban planning, Water resources development, Upstream, Downstream, Competing uses, Legal aspects.
Identifiers: *Interdisciplinary approach.

A multi-disciplinary approach to urban water resources development poses certain problems, including role conflicts and the status of the engineer vis-a-vis other disciplines. One of the most pressing legal problems in metropolitan water resources is the upstream-downstream situation. There is a need to codify much of the common law relating to water. The sustems approach to metropolitan water resources development is suggested as a method of achieving progress. Different objectives cause tensions in maximization processes because of the varying degree to which persons are benefited. Rational criteria for selection of projects is necessary; these criteria require the quantification and/or identification of impacts, direct and indirect. Determining the desires of society is often complicated by the fact that there are multiple interests. Reconciliation of these often conflicting needs require the development of a sophisticated methodology for measuring values and needs. (Starr-Chicago)
W69-08629

REFLECTIONS ON THE RELATIONSHIPS BETWEEN SOCIAL SCIENCE AND HYDROLOGICAL ENGINEERING,
Colorado State Univ., Fort Collins.
Duane W. Hill.
In Water and Metropolitan Man, An Engineering Foundation Research Conference, ASCE Urban Hydrology Research Council, Appendix D, p 87-90, 1968.

Descriptors: *Social change, *Social values, Social needs, Psychological aspects, Urban sociology, Water resources development, Aesthetics, Social impact, Decision-making, Research and development.
Identifiers: *Social costs, *Social benefits.

Since engineering facts have deep social consequences, the author contends there is no excuse for the failure of engineers and social scientists to collaborate in their research efforts. There is a need to know how engineering feats and technological transformation affect and direct the social system. The social scientists can be of the greatest help to the engineer in developing and refining measures for quantifying social values, social costs and social benfits. Eight critical needs for research are outlined: (1) information on how legal systems relate to and affect both engineering and/or social systems; (2) effects of both public and private decisions and a greater delineation between the responsibilities of the two sectors; (3) ways for consolidating water resource administration; (4) analysis of planning and planning behavior; (5) develop criteria for preserving engineering, safety and aesthetic values; (6) knowledge about the formulation and behavior of public and decision-making coalitions; (7) knowledge about the roles and impacts of those roles or urban hydrology in the model city programs; and (8) knowledge about what motivates publics and their decision makers. (Starr-Chicago)
W69-08631

SOCIOLOGICAL AND SOCIAL PSYCHOLOGICAL FACTORS RELATED TO METROPOLITAN WATER RESOURCES DEVELOPMENT,
Utah State Univ., Logan.
Wade H. Andrews.
In Water and Metropolitan Man, An Engineering Foundation Research Conference, The ASCE Urban Hydrology Research Council, Appendix C, p 79-86, 1968.

Descriptors: *Social change, Social needs, Social values, Psychological aspects, Urban sociology, *Water resources development.
Identifiers: *Community structure, Interdisciplinary studies.

The need for an interdisciplinary approach to metropolitan water resources development is acknowledged and the problem of communication between disciplines is seen as a real obstacle to the development of such an approach. Examples of sociological theory and analysis that could be applied to the problems of water are: values; social organization; social action; the process of diffusion of ideas; and research methodology. Values relating to one thing, as in the case of economic maximization may be outweighed by other values and choices cannot be made based on rational economic goals. Research on social organization and analysis of community structure and decision-making processes are useul for predicting social behavior. Social action has been studied by sociologists and a model containing five components has been identified. These components are: (1) convergence of interest; (2) establishment of an initiating set - including those with the right to initiate and those with the obligation to respond; (3) legitimation and sponsorship; (4) establishment of an execution set and mobilizing of community group resources; and (5) fulfillment of the objective of the initiating set - or carrying out of the programs. Urban water resources development is seen as being integrally connected with other social processes. All elements of an urban system must be related to any major resource development if archaic social and economic patterns are to be changed. (Starr-Chicago)
W69-08632

WATER SUPPLY STUDY: WARE RIVER A
Central Massachusetts Regional Planning Co
sion.

Central Massachusetts Regional Planning Co
sion Report, June 1969. 86 p, 17 tab, 12 fig.

Descriptors: *River basin development, *W
supply, *Water quality, Future planning, Dra
engineering, Surface-groundwater relations
Population growth rates.
Identifiers: Central Massachusetts Reg
Planning Commission, Worcester (M
metropolitan area, Comprehensive planning, W
River.

The study area for this drainage basin study c
the northwestern edge of the Worc
metropolitan area. The purpose of this repor
to provide a comprehensive plan for the dev
ment of public water supply systems to serv
study area's expected future needs. Future nee
the area were based on data developed by the
tral Massachusetts Regional Planning Commis
The data indicate that up to the year 2000 a p
lation increase of only 40 per cent can be exp
and most of this will occur in and aroun
present population centers. Potential source
future supplies identified and alternative s
solutions are suggested. Five recommendation
made: (1) Engineering investigations be condu
in areas recommended for well development
these areas be reserved for development as re
mended in the proposed plan; (2) Engineerin
dies on existing or future water systems be
ducted when development or expansion o
system is needed; (3) Implementation of any
grams recommended for 1970 be initiated
mediately; (4) Engineering aspects of allocati
water from Muschopauge Pond be further e
ated in a regional study including the entire Ce
Massachusetts Regional Planning District; an
The recommended plan and program be eval
and updated within ten years. (Starr-Chicago)
W69-08637

A GENERAL SUMMARY OF THE STATE RESEARCH ON GROUNDWATER HYDRO GY IN DESERT ENVIRONMENTS,
Arizona Univ., Tucson.
For primary bibliographic entry see Field 02F.
W69-08688

A LONG RUN FINANCIAL PLANNING MO FOR SMALL WATER SERVICE UTILITIE MISSISSIPPI,
Mississippi State Univ., State College. W
Resources Research Inst.
A. A. Armenakis, and G. T. Peden, Jr.
Completion Report to the Office of W
Resources Research, Department of Interior,
1969. 51 p. OWRR Proj No A-025-MISS.

Descriptors: *Water rates, Model, Fina
planning, *Pricing methods, Water systems.

The purpose of this study was twofold. The fir
to determine if the pricing practices of small
munities in Mississippi were financially
economically sound when related to each co
nity's goals and demands. The second purpos
to design a long-run water rate model that co
effectively used to compute a single water rat
would reflect the time value of money and
meet certain requirements as prescribed b
water service utility. A mail questionnaire
designed specifically to assist in determ
whether current pricing policies were cons
with sound economic and financial theories. I
sending an initial questionnaire to 89 municip
and two follow-up questionnaires to those reli
to cooperate, 42 water utilities responded
most important observation was that a condit
inadequate long-range financial planning exis
the overwhelming majority of utilities. To o
come this financial inefficiency a mode
developed by the authors that could be use

l water utility in setting water rates commensu- with sound financial and economic theories. financial planning model comprises a com- ion of two pricing methods set forth in the stu- l all, three methods were developed. However, certain requirements as prescribed by the cipality, the water utility can select a method the payout method or rate of return method utilize the chosen method in conjunction with lanned revenue approach method. The result financial planning model which meets ribed requirements and reflects the time value oney. (Author)
-08691

ERALIZED PARTICIPATION OF VOLUN- Y LEADERS IN LOCAL WATERSHED JECTS,
issippi State Univ., State College. Water urces Research Inst.
Wilkinson, and R. N. Singh.
pletion Report to the Office of Water urces Research, Department of Interior, July . 48 p. OWRR Proj No A-028-MISS.

riptors: Social science, Organization, Commu- Attitudes.

relationship between participation in rshed development projects and in general munity activities and organizations was ex- ed. Names and addresses of 335 members of ial boards of water management districts in issippi were secured from the state office of Soil Conservation Service. A questionnaire gned to measure extent and intensity of par- ation in water management generally, in a ific local watershed development project, and ommunity activities was mailed to each board ber. Completed questionnaires were received 197 respondents. All measures, including e Guttman-type attitude scales, were coded for puter analysis. Cross-tabulation tables were tructed and chi square and gamma tests were ormed to examine the relationship between of five indicators of the dependent variables ticipation in the watershed project) and the in- ndent variables. Findings were generally con- nt with theoretical predictions, to wit that e and level of participation in watershed lopment is positively related to generality of community role of the actor. Practical implica- s of this finding and of the theory which it sup- s are elaborated in the completion report. thor)
-08692

. IMPACT OF RESERVOIRS ON LAND UES: A CASE STUDY,
issippi State Univ., State College. Water urces Research Inst.
Williams, Jr., and D. L. Daniel.
pletion Report to the Office of Water urces Research, Department of Interior, June . 32 p. OWRR Proj No A-026-MISS.

riptors: Reservoir, Land values, Land prices.

study was deemed important due to the ber of reservoirs either being constructed or in lanning stage at the present time. The creation reservoir and the taking of land for purposes of ervoir ultimately cause changes in land usage land values. These changes are of interest to: hose whose land is acquired, (2) those whose use and/or value are directly or indirectly af- d, (3) the organization or agency responsible aking the benefit-cost analysis for the project, 4) the general public who must pay for many projects through taxes. For purposes of this , land prices were defined as market sales s and land values were defined as the capital- values of the income stream of land. Large in- es in land prices were found to have occurred e five years after the announcement of the voir site in a sample area near the reservoir. ever, multiple regression analysis indicated factors other than the reservoir may have played important roles in causing the high prices. The most important of these factors was proximity to and growth in a large city. Changes in values and prices of land which could be attributed to the reservoir occurred in areas where the reservoir caused a shift in land use. Little or no increases in the productivity of land occurred in existing uses of land. Productivity increases occurred when land use shifted. The characteristics of the reservoir and surrounding land areas in general determined the extent of changes in land use as a result of the reservoir. In this case, a buffer zone of about 18,000 acres was acquired with the reservoir. It is held by a public agency for controlled development. This factor limited the measurable effect of the reservoir on land values as determined through market forces. (Author)
W69-08693

NUCLEAR ENERGY AND THE AGRO-INDUSTRIAL COMPLEX,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 03F.
W69-08840

THE ROLE OF RESEARCH AND OPTIMIZATION IN REDUCING THE COST OF HYDRO DEVELOPMENTS,
Bechtel Corp., San Francisco, Calif.
Harry Sutcliffe, and Michael D. Hayes.
Pap, Amer Soc Civ Eng Nat Meet Water Resour Eng, New Orleans, La, Feb 1969. 22 p, 6 fig.

Descriptors: *Hydroelectric power, Costs, *Optimization, Recreation, Pumped storage, Benefit-cost ratios, Technology, Research facilities, Research and development, Cost-benefit analysis, Electric power, Production, Economics, Reliability, Projects, Feasibility, Engineering, Investigations.
Identifiers: Pollution control, *Cost savings.

Areas in which improved technologies can control hydro development costs are examined. The changing role of the hydro project is discussed and areas for new research are suggested. The contribution of optimization technique in maximizing return to an owner is reviewed in the light of increasing pressures for more recreation, pollution control, and other nonrevenue-producing features. A wider benefit-cost ratio, that of benefit to the community as a whole rather than to the owner, must be optimized when considering a project. Sharing research data can benefit technology and reduce costs. The need for a domestic research center capable of testing turbines, pumps, valves, energy dissipators, and measuring large flows is discussed. (USBR)
W69-08855

REGIONAL GOALS AND THE PLAN.
Northeastern Illinois Planning Commission, Chicago, Ill.

IN Diversity Within Order, Northeastern Illinois Planning Commission, Chicago, Ill, March 1967, p 53-55.

Descriptors: Estimated benefits, Economic impact, Social mobility, Aesthetics, Parks, Economic efficiency, Land use, Water demand.
Identifiers: Chicago, Northeastern Illinois, Illinois.

Chapter V evaluates the Finger Plan for the Chicago metropolis on the basis of its achievement of economic, social, and physical regional goals. In terms of economic health, industrial sites should have good access to labor markets, and suppliers. In terms of social mobility, the improved mass transportation system will allow the poor to easily reach places of employment, as well as other facilities. In terms of physical attractiveness, health, and convenience of the region, parks and open spaces, are placed close to the concentration of population. Under the proposal plan, one can change jobs inside the region without having to move to a new home. The plan utilizes the surplus capacity of railways, thus keeping expense at a minimum. Linear development permits public utilities with excess capacity to be extended from established communities. In terms of optimum use of natural resources the plan provides large natural settings close to populated areas. The concentration of water demand may exceed ground water supplies, but the arrangement of population centers facilitates the use of Lake Michigan water. (Gossen-Chicago)
W69-08876

THE FINGER PLAN - A CONCEPT OF ORDER.
Northeastern Illinois Planning Commission, Chicago, Ill.

IN Diversity Within Order, Northeastern Illinois Planning Commission, Chicago, Ill, March 1967. p 15-39, 12 fig, 7 ref.

Descriptors: *Flood Plain Management, *Landfills, *Area redevelopment, Urban areas, Highways, Railroads, Public benefits, Industries, Conservation, Land use, Water storage.
Identifiers: *Chicago, Residential communities, Northeastern Illinois, Historic sites.

Chapter III describes the Finger Plan for the Development of the metropolitan six-county area of Chicago. Its development pattern resembles a hand whose palm is solidly urbanized and whose fingers form strings of communities. The skeleton of the hand is the transportation system featuring a complementary system of expressways, rapid transit rail lines, and commuter rail lines. Each finger is formed linearly by a passenger rail line and/or an expressway. Major regional centers of activity, i.e. universities, large hospitals, industrial parks, and shopping centers are regularly spaced along transportation systems of the palm and the fingers. Residential communities containing their own educational, neighborhood shopping, and recreation facilities fill out this skeleton. Major recreation parks, golf courses, cemeteries, agriculture, and large lot residential areas are located between the fingers. There are six principal development policies, relating to transportation, regional centers, open space, industry, residential communities, and natural resources. Each is discussed at length. Conservation of land, air, and water resources is recommended. Lands subject to flooding, poor drainage, and unstable soil conditions are unsuitable for urban use. Appropriate lands for refuse disposal sites, water storage sites, of special scenic or historic value, and of mineral deposits must be identified. (Gossen-Chicago)
W69-08877

ESTABLISHING PRIORITIES FOR PUBLIC INVESTME NTS,
Office of the Secretary of the Army, Washington, D.C. Systems Analysis Group (Civil Functions).
Jim J. Tozzi.
Systems Analysis Group (Civil Functions), Office Secretary of the Army, June 1969, Washington, DC. 21 p, 8 ref.

Descriptors: *Economics, *Investment, *Cost analysis, *Government finance, *Social participation, Area redevelopment, Water resources development, Project planning, Cost benefit analysis, Cost benefit ratio, Economic efficiency, Economic impact, Social values, Social aspects, Social impact, Social need.
Identifiers: Appalachian Water Resources Program, Objectives.

This paper proposes to outline a methodology which highlights, for any proposed investment, its contribution to the well-being of some groups, its detrimental effects on other groups and an alternative use of the same resources. This process, which is based on the establishment of priorities, consist of four steps: specifying the objectives to be attained; assessing the contribution the investment makes toward the fulfillment of each objective; as-

sessing the cost of the investment; and soliciting public reaction to the proposed investment. The execution of this process implies the need to make value judgments; judgments whose implications must be clearly presented to the general public. Each of the four steps is described with an emphasis on questions of economic methodology. In addition, each step is illustrated by examples from water resource investment projects. Among the salient conclusions were: the need to replace benefit-cost ratios with other indices which measure specific effects of investment; the complete identification of effects of public investment will likely cause changes in program content; and knowledge of effects of public investment will prevent the unequal or unfair distribution of benefits. (Davis-Chicago)
W69-08890

WILL A LAKE AIRPORT BEST SERVE THE CHICAGO AREA.

Open Lands Project, Chicago, Sep 1968. 56 p, 3 illus, 3 append.

Descriptors: *Lake Michigan, *Water management, *Water pollution, *Recreation, *Social values, Oil wastes, Pollutants, Recreation facilities, Political aspects.

This report presents a number of arguments against the construction by the City of Chicago of a proposed large airport in Lake Michigan. Although this paper deals with many factors not related to water, a number of points is made regarding water management problems in an urban context. The following topics were discussed in detail: comparison of site costs, population growth factors, political implications, time schedule, construction problems, airport and runway orientation, air safety, noise hazards, ground traffic accessibility, air pollution, water pollution, effects on recreational boating, related commercial developments, and civic beauty. A number of conclusions related to water management was made. Construction of a polder-type lake airport would contribute to two types of water pollution assuming airport runoff is treated, pollution from aerosol-type exhause from jet aircraft, and pollution effects caused by the disruption of lake circulation patterns. Transportation causeways as well as the airport itself would be detrimental to recreation uses of the lake. Finally, the construction of an airport in Lake Michigan would seriously impair the value of the city's only unique natural resource. (Davis-Chicago)
W69-08892

STUDY OF INDUSTRIAL GROUND-WATER RESOURCES IN THE TSURUGA PLAIN, FUKUI PREFECTURE (JAPANESE),
Industrial Science and Technology Agency, Kawasaki (Japan). Geological Survey.
For primary bibliographic entry see Field 02F.
W69-08895

ENVIRONMENTAL ASPECTS OF RIVER BASIN PLANNING,
North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
Maynard M. Hufschmidt.
J of the Hydraulics Div, Proc of the Amer Soc of Eng, Vol 93, No HY6, Proc Paper 5605, p 323-333, Nov 1967. 11 p, 21 ref.

Descriptors: *Resources, *Hydraulics, Rivers, Systems, Analysis, Cost-benefit analysis.
Identifiers: Environmental quality, Comprehensive planning.

Current methods and administration of river basin planning must be changed substantially to accommodate the increasing national concern for problems of environmental quality. Modifications will be required in planning theory: improvement of environmental quality should be adopted as a major national objective, along with the objectives of economic efficiency and income distribution. Changes are also needed in methods of computing benefits, cost and production functions, and in the planning process and techniques. Systems analysis methods must incorporate many environmental quality parameters and alternative development and management measures. Planning for river basins and for metropolitan areas must be integrated. Important changes required in water resources policy, organization and administration are discussed. (Grossman-Rutgers)
W69-08969

SOME DEVELOPMENT POTENTIALS OF THE NATURAL RESOURCES OF THE ATLANTIC COASTAL PLAINS,
North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
Maynard M. Hufschmidt.
Econ Dev Potentials of the Atlantic Coastal Plains Reg, Agr Policy Inst., North Carolina State Univ., Series 26, p 51-53, June 1967. 3 p, 1 ref.

Descriptors: *Conservation, Public benefits, Long-term planning, Project planning.
Identifiers: *Environmental quality, *Environmental deterioration.

Policy makers must be careful to ensure that economic development does not detract significantly from scenic, historic and environmental values. The absence of major mineral deposits in the region is to the advantage of the environmental quality of the region. Another resource issue relates to the value from both the regional and national point of view of preservation as ecological preserves of major portions of the swamps and estuaries of the region. Thirdly, there is the question of how high the quality of the environment should be maintained. Through rational planning principles and techniques a balance between development and preservation which will be for the long range benefit of the region and the nation can be achieved. (Grossman-Rutgers)
W69-08970

RISK, IMPERSONALITY, AND THE SOCIAL WELFARE FUNCTION,
Delhi School of Economics (India).
Prasanta K. Pattanaik.
Jour Pol Econ, Vol 76, No 6, p 1152-1169, Nov/Dec 1968. 18 p, 1 fig, 1 tab, 17 ref.

Descriptors: *Welfare, *Risks.
Identifiers: *Individual preferences, *Subjective preferences, *Social welfare function, *Preference patterns, *Ethical preferences, Intransitivity, Expected utility.

The concept of 'ethical preferences' as developed by Harsanyi (1955) is persuasive enough to justify the qualification 'ethical', and it is the combination of risk and the 'extended sympathy' type of comparison which accounts for this persuasiveness. Ethical preferences can be used as the ingredients for deriving social preferences, and in some respects this procedure is more appealing than the Arrowian procedure of deriving social preferences from the individual's 'subjective preferences.' Granted that individual 'ethical preferences' can be represented by von Neumann-Morgenstern utility indexes this in itself does not solve the problem of aggregation, because 'ethical preferences' will not necessarily be identical for different individuals. The problem of reducing different individual's welfare indexes to a comparable basis is serious in view of the uniqueness only up to linear transformation of the von Neumann-Morgenstern indexes. No less serious is the fact that Harsanyi's 'ethical preferences' may not at all satisfy the von Neumann-Morgenstern or the Marschak axioms. The axioms of 'reduction of compound lottery' and of 'complete ordering' are particularly open to serious doubts of a type that does not arise with 'subjective preferences.' If a social welfare function could be satisfactorily derived, this condition would improve efficiency of decisions concerning allocation of resources, including water resources. (Sokol
Rutgers)
W69-08974

PERSPECTIVE ON CONSERVATION ESSA ON AMERICA'S NATURAL RESOURCES,
Resources for the Future, Inc., Washington, D.C
The Johns Hopkins Press, Baltimore, 1958. 260
Henry Jarrett, Editor.

Descriptors: *Conservation, *Natural resourc Resource development, Resource allocati Technology, Costs, Demand, City planning, Oil titudes, Land, Water resources, Mineralogy, En gy, Recreation, Fish management, Wildl management.
Identifiers: Science, Malthus, Living standar Value problems, Urban growth, Resource poli Laissez faire, Social structure.

The aim of this book, as of the Resource for the ture Forum on which it is based, is to bring exp opinion to bear upon a few resource problems wide interest and significance. Specifically, book seeks to shed light on some of the resou conservation problems of the next fifty years fr the vantage point of a critical review of the past ty. In using the past as a springboard for appaisi the present and future, hard questions arise and essays in this book explore some of them. For ample, what forces during the past fifty years ha shaped American concepts of conservation and titudes toward it. What have been the really imp tant issues and trends in land and water, miner and energy, outdoor recreation, and fish and w dlife management. How have resource develo ment policies and programs affected the natio economy, political life, and social structure--a vice versa. Most important of all, what guidan does the record of the past offer for the futu (Loeb-Rutgers)
W69-08975

MEASURING THE RATE OF RETURN C CAPITAL,
Sheffield Univ. (England).
A. A. Sampson.
Jour of Finance, Vol XXIV, No 1, p 61-74, M 1969. 14 p, 4 tab, 13 ref, append.

Descriptors: *Regression analysis, *Capital, Fina cial analysis, Profit, Time-series analysis, Lon term planning, Investment, Marginal productivity
Identifiers: *Distributed lag model, *Rate return, Cross section analysis, Discounted cas flow, Time profile, Price changes, Capital-lab ratio.

This paper presents the results of an attempt to es mate the rate of return on capital via regressi analysis of financial data. A model relating curre profits to current and lagged inflows of long-te capital is considered and fitted to a set of data fr the British Mechanical Engineering Industry. Bo time-series and cross-section data are use Acquisitions of long-term capital are measured summing depreciation provisions, retain earnings and receipts from issues of ordinary shar and instruments of long-term debt. The motivati behind the exercise described in this paper is a fe ing that microeconometric analysis might provi useful information about financial performances the industrial sector. The discounted cash-flow ra of return on capital is one of the most importa dimensions of financial performance, and increa ing emphasis is being placed on it in the literatu on management and decision-making. This a proach might be useful in determining the rate return on capital invested in water resource pr jects. (Author)
W69-08977

PROBLEMS IN THE COOPERATIVE ALLOC TION OF PUBLIC EXPENDITURES.
Maryland Univ., College Park; and Urban Ins Washington, D.C.

tin C. McGuire, and Harvey A. Garn.
rt Jour Econ, Vol LXXXIII, No 1, p 44-59, Feb
9. 16 p, 4 fig.

criptors: *Resource allocation, *Cost sharing,
eral project policy, Welfare, Multiple purpose,
-benefit analysis.
tifiers: *Public expenditure, *Grants-in-aid,
ject selection criteria, Joint products, Budget
traint, Subsidy, Acceptance curve, Pareto op-
l behavior.

blems of cost sharing between federal agencies
etween grantor and grantee derive from the
that, generally, more than one public agency
contribute to the cost of a single project. At
two levels of government--federal and local--
share in a project's cost; often two or more
cies of the federal government will contribute
ne same project, and for different objectives.
ce, joint products and multiple objectives are
rent in the resource allocation decisions
ussed in the paper. Short of specific reorganiza-
to achieve this goal, the individual decision
er can only single out a few other agencies to
rdinate' with. In view of the fact that major in-
ependencies of this kind exist among recent
at Society programs, the possible losses due to
optimal behavior by government agencies
d be substantial, even more so now with total
ual expenditures for project oriented activities
approaching $17 billions. Therefore, attention
n to coordination of federal programs should
ude much more detailed empirical analysis
cted at establishing the best division of authori-
r sub-optimization. The above is especially ap-
able to the case of water programs which in-
e many interdependencies of efforts among
ernmental agencies at all levels. (Sokoloff-Rut-
)
9-08979

E ECONOMICS OF REGIONAL WATER
ALITY MANAGEMENT,
ources for the Future, Inc., Washington, D.C.
primary bibliographic entry see Field 05G.
9-08981

UT DEMAND FUNCTIONS FOR THE
OFIT-CONSTRAINED SALES-MAXIMIZER:
OME EFFECTS IN THE THEORY OF THE
M,
iol Coll., Oxford (England).
) Portes.
nomica Vol XXXV, No 139, p 233-248, Aug
8. 4 fig, 16 ref.

criptors: *Demand, *Income, Profit, Utility,
ginal utility, Marginal cost, Prices, Taxes,
ernment, Industrial production, Equilibrium.
tifiers: *Sales, Market, Sales-maximization, In-
e effect, Substitution effect.

position of quasi-public firms in the water
urces area is such that this paper should prove
ul to the water resource planner. This study
siders the demand for inputs of a firm which
imizes sales subject to a profit constraint,
:r perfect competition in input markets and im-
ect competition in the output market. The
or seeks to determine how such a firm would
its input mix as input prices and output vary
ugh the use of a detailed comparative-statics
ysis. Equilibrium conditions, yielding input de-
d functions, are derived. The Slutsky equation
sed to study the effects of changes in input
es and to observe the explicit income and sub-
tion effects. The phenomena of Giffen inputs
discussed and comparisons made. Finally, it is
vn that if there is no regression, the sales-max-
ers price-elasticity of demand for any input will
greater than that of the profit-maximizer.
rphy-Rutgers)
)-08985

NOMIC MEASURES IN THE RATIONAL
LIZATION OF WATER RESOURCES,
oiter.

Problems of Economics, Vol 11, No 3, p 33-44, Jul 1968. 12 p, 6 tab.

Descriptors: *Natural resources, *Water utilization, Water pollution, Economics, Water shortage, Water supply, Prices, Costs, Consumptive use.
Identifiers: *Economic measures, Economic reform, USSR, Quality.

The entire course of the USSR economic reforms presently being carried out poses the problem of increasing the effectiveness of utilization of the richest natural resources that the country has at its disposal. A necessary prerequisite of all measures and, in particular, of those aimed at the solution of this problem is the economic evaluation of natural resources being used at the present time and those which will be brought into economic circulation in the near future. Under these conditions, the search for and development of a methodological basis for the economic evaluation of natural resources is a natural phenomenon. Such a basis must be uniform for various types of natural resources and must by a kind of yardstick for concrete methods and ways of making economic assessments of them at the same time taking into account the specific features of the use of alternative natural resources. The author discusses the problem of water shortages in several regions of the USSR and the basic principles in the establishment of payments for the use of water resources. This later discussion, along with the general resource analysis of the paper may be of relevancy to water conservation and planning studies in this country. (Loeb-Rutgers)
W69-08987

SOME PROBLEMS OF CRITERIA AND ACQUIRING INFORMATION,
California Univ., Los Angeles, Calif.
Roland N. McKean.
IN Environmental Quality in a Growing Economy, Baltimore, The Johns Hopkins Press, 1966. p 61-65, 5 p, 1 ref. Henry Jarrett, Editor.

Descriptors: *Government, *Pollution, *Optimization, *Economic efficiency, Effluents, Erosion, Pollution, Taxes, Fish stocking, Subsurface water, Fisheries, Water supplies, Costs, Smog, Value, Input-output analysis.
Identifiers: *Externalities, *Public sector, *Private sector, Goods, Services, Steel, Marginal value, Noise abatement, Gains.

This article begins with the idea that action concerning an externality is appropriate only if gains promise to exceed costs, whatever value system is being used as criteria. Not to abolish an external cost would not, then, necessarily indicate a deviation from attainable optimality. As far as the decisions about actions to be taken by government are concerned, the author points out that judgments about many items may properly enter, since there is no fundamentally correct criterion in group decision making. Because of equity considerations, various efficiency boundaries in such decisions may be disputed, yielding legitimate disagreements about the nature of these boundaries and the prices to be attached to various goods and services. In considering gains/costs relationships, the cost of acquiring the relevant information should be considered, along with the cost of internalizing the externality. Both these processes can be so expensive as to be uneconomical and far from an improvement of the situation at hand, whether it be a question of noise reduction of pollution abatement. In both the public and private sector, the rights of certain individuals to resources and services are ill-defined, and decision-makers are restricted to 'groping in the dark.' Water resource analysts can use this article as a guideline for assisting their own decision-making process. (Murphy-Rutgers)
W69-08990

THE EFFECTS OF LOW-COST HYDRO POWER ON INDUSTRIAL LOCATION,
Manitoba Univ., Winnipeg.
Gunter Scramm.
Canadian Journal of Economics, II, No 2, p 210-229, May 1969. 20 p, 2 fig, 6 tab.

Descriptors: *Hydroelectric power, *Costs, Tennessee Valley Authority Project, Electricity, Industrial production, Magnesium, Aluminum, Technology.
Identifiers: *Hydropower, *Industrial location, Bonneville Power Administration, Canada, Power-intensive industries, Chemical pulp, Titanium sponge, Atomic power.

Past experience shows that the availability of low-cost hydro power can significantly affect the locational decisions of power-intensive industries. In the United States the developments of the Tennessee Valley Authority in the Southeast and the Bonneville Power Administration in the Northwest have led to large-scale settlements of such industries in areas which, with the exception of low-cost energy, generally offered neither suitable local raw materials sources nor nearby markets. Similar developments took place elsewhere. A main reason for Canada's and Norway's large export oriented electro-metallurgical and chemical industries are favorable hydro power sources in close vicinity to tidewater locations. The author examines whether the underlying cost-price relationships of these locational decisions are still valid for the present and the foreseeable future. This is a question of considerable interest to Canada because it is one of the few industrialized nations that still has substantial sources of undeveloped hydro power available. It is of great interest also to the undeveloped countries that are rich in hydro resources but unable to utilize them unless substantial industrial energy loads are developed at the same time. (Loeb-Rutgers)
W69-08991

NEW TASKS FOR ALL LEVELS OF GOVERNMENT,
Brandeis Univ., Waltham, Mass.
Norton E. Long, and Henry Jarrett.
Environmental Quality in a Growing Economy, Baltimore, The Johns Hopkins Press, 1966, p 141-155. 15 p.

Descriptors: *Governments, *Statistics, *Urban renewal, Air pollution, Water pollution, Value, Pesticides, Sewage, Income, Taxes, Watersheds, Waste disposal, Investment.
Identifiers: *Environmental quality, *National policy, *Laissez-faire, Tax surplus, Free market, Budget, Housing.

The article discusses the need for indicators of environmental quality to be built into the national public reporting system at the Presidential level since the Federal Government has the greatest freedom from fiscal constraint in its initiatives. The factor of political expediency is suggested to be a mainspring of the technology through which things get done about air and water pollution, pesticides, urban transport, flights, floods, and the like. The contenders for a share in Federal political expediency actions in the area of environmental control are primarily the Housing and Urban Development Department, and the Departments of Health, Education and Welfare, Commerce, The Interior, Agriculture, and Labor. Action at the Federal level can result in regionalized areas and staffs which act as the arm for Presidential field coordination, thus permitting regional problems to be dealt with most effectively, whether of a metropolitan, a watershed, or a drainage difficulty. Another possibility would be internalizing the costs of some problems, such as controlling pollution, to industry, with Federal supervision. Improving the quality of the environment can be achieved part-way by the leadership and fiscal aid of Washington, and complemented by metropolitan and/or regional government action. (Murphy-Rutgers)
W69-08993

A REINTERPRETATION OF THE PURE THEORY OF EXHAUSTION,
Pennsylvania State Univ., University Park.
Richard L. Gordon.
Jour Pol Econ, Vol 75, No 3, p 274-286, June 1967. 13 p, 12 ref, 1 append.

Descriptors: *Natural resources, *Profit, Competition, Costs, Prices, Conservation, Technology, Monopoly, Equilibrium, Constraints, Interest rate.
Identifiers: *Exhaustion, *Increasing costs, Social costs, Maximization, Present value, Uncertainty, Reserves, General industry model, Output, User costs.

Eventual exhaustion of natural resources is often regarded as a serious economic problem, but the theory of the subject remains somewhat inadequate. A more comprehensive model generalizing prior analyses and re-evaluating the empirical implications of the theory is needed. Extensions are also required to analyze the vital distinction between optimal centralized management and the collective behavior of separate firms in a competitive industry. The literature is reviewed and a theoretical model developed which incorporates most prior analyses as special cases. At this stage it is assumed that only current output affects profits. Later the more general case in which past production also influences current profits is considered. The difficulties in developing a general industry model are also discussed. This section neglects the complication produced by the effects of past production on profits, and relates existing models to industry analysis. A model using linear cost and demand functions to show that efficient social decision making can produce different results from private, competitive behavior is developed in the appendix. Much of what is derived here for any natural resource could be applied to problems in water resources management. (Sokoloff-Rutgers)
W69-08997

CONCERNING EVALUATION OF NATURAL RESOURCES,
lu Sukhotin.
Problems of Economics, Vol XI, No 2, p 29-39, June 1968. 11 p, 1 tab.

Descriptors: *Natural resources, Water resources, Water pollution, Productivity, Profit, Legal aspects, Administrative decisions, Value, Rent, Industrial wastes, Compensation, Linear programming.
Identifiers: *Economic evaluation, *Complete cost accounting, *Accounting price, *USSR, Socially necessary expenditures.

One of the most complex problems is the economic evaluation and organization of cost accounting relations with respect to water resources since joint use is made of them. The use of water can be on a returnable basis (for example, electric power stations) and also on a non-returnable basis. The largest consumer of water on a non-returnable basis at the present time is agriculture. If non-returnable consumption by any user of water does not reduce the water supply of the remaining users, a given source of water is not as yet a limited resource and does not have an economic evaluation. However, in many regions users of water must pay for non-returnable consumption according to the outlays required for replacement. If this consumption results in (for example) poorer navigation conditions, outlays for replacement take the form of additional outlays for shipping part of the goods by other means of transport. Pollution is one of the most serious factors in the increasing dimunition of water resource. As a result of pollution, various types of compensatory outlays must be made. The entire sum of these additional national economic costs must be fully compensated for by the enterprises contaminating the water. This article could be useful in a comparative study of the economic evaluation of water resources. (Sokoloff-Rutgers)
W69-08998

A UTILITY MEASURE BASED ON TIME PREFERENCE,
Dayton, Ohio.
Hermann Enzer.
Econ Jour, Vol LXXVIII, No 312, p 888-897, Dec 1968. 10 p, 7 ref.

Descriptors: *Cost-benefit analysis, Water supply, Public benefits, Probability.
Identifiers: *Public projects, *Ordinal utility function, *Time preference, Market prices, Subjective measures, Ordering, Public goods, Mathematical expectations.

In a recent survey Prest and Turvey discussed the applications of cost-benefit analysis to such public projects as water supply, transportation, health and education, and defense. Lack of emphasis on these areas is due to the fact that cost-benefit analysis when applied to these areas, is essentially only cost analysis. The author endeavors to seek a utility measure for the set of items that do not have market prices and for which none may be derived or imputed, such as in the case of water-supply projects. One cannot fall back on an ordinal utility measure and derive anything better than a ranking precisely because there are no market prices. The author believes that any attempt to improve upon the necessarily subjective measures that are usually applied might be worth the effort. A utility measure is suggested which, in certain circumstances may provide reasonable approximations to the relative utilities of a set of items that do not possess market prices. As in the case of other measures that have been constructed, such as the von Neumann-Morgenstern measure, or the Pareto-Lange approach of comparing utility differences, some of the assumptions made are questionable. The author believes that his approach is an improvement over some of the other utility measures which have been defined on orderings of items that may not have market prices. (Sokoloff-Rutgers)
W69-09001

THE MEASUREMENT OF UTILITY,
Case Western Reserve Univ., Cleveland, Ohio.
C. Hillinger.
Rev Econ Studies, Vol XXXVI (1), No 105, p 111-116, Jan 1969. 7 p, 4 ref.

Descriptors: *Marginal utility, *Elasticity of demand, Consumptive use.
Identifiers: *Utility maximization, *Income elasticities, *Intertemporal allocation, Relative prices, Econometric studies, Demand function, Luxury goods, Mean value theorem.

This paper shows how the utility levels attained by a consumer may be measured exactly under idealized conditions. These conditions include knowledge of the trajectories of prices, income, and quantities, and of the numerical magnitudes of certain elasticities. This approach provides a ranking for all consumption vectors on the trajectory. An analytical expression is given, showing the effects on the marginal utility of income of changes in income and in relative prices. These effects depend on the income elasticities of commodities and on the income elasticity of the marginal utility of income. This provides a link between a number of concepts and parameters in consumer theory. The result also lends itself to empirical application. Estimates of the demand elasticities are available from many econometric studies. The less well known elasticity of the marginal utility of income plays a role in intertemporal utility maximization. It is shown how this may be estimated following Samuelson, by using data on total consumption expenditures over time. The ability to derive a grand utility function would aid policymakers in the optimum allocation of resources. These decisions could include important water resources allocation problems. (Sokoloff-Rutgers)
W69-09003

COST-BENEFIT ANALYSIS: A SURVEY,
Manchester Univ. (England).
A. R. Prest, and R. Turvey.
The Economic Journal Vol 75, No 300, p 683-735, December 1965. 53 p, 2 fig, 90 ref.

Descriptors: *Project planning, *Cost-benefit analysis, Benefits, Welfare economics, Financing, Resources, Flood-control, Investment, Indirect benefits, Irrigation, Project life, Prices, Supply, mand, Wages, Taxes, Government, Interest r Budgeting, Value, Roads, Recreation, Transpo tion.
Identifiers: *Hydroelectric power, Savings, Wa ways.

Cost-benefit analysis, as a practical way of sessing the desirability of projects is of vital portance in the water resource area. In this art the authors provide a general survey of the en area of benefit-cost analysis. The first section lines the development and scope of this type analysis. The second section deals with the gen principles of benefit-cost study. The next sec provides a survey of the applicability of the anal to various fields. Included here is the discussio its applicability to water resource projects with ticular regard to flood control, irrigation hydroelectric power. In the last section the are benefit-cost analysis is reviewed within the prec ing framework. The conclusion points out the ficulties of evaluation, especially on the benefit of the analysis but notes the significant usefuln in the area of project evaluation. (Murphy-R gers)
W69-09005

BENEFIT-COST ANALYSIS AND PUBL RESOURCE DEVELOPMENT,
California Univ., Berkeley.
S. V. Ciriacy-Wantrup, S. C. Smith, and E. N. Castle.
Economics and Public Policy in Water Resou Development, Ames, Iowa, Iowa University Pr p 9-21, 1964. 13 p, 9 ref.

Descriptors: *Cost-benefit analysis, *Governm *Economic justification, Resource developme Direct benefits, Physical properties, Polit aspects, Cost allocation, Market value, Recreat Cost repayment, Employment, Costs, Taxes.
Identifiers: *Extramarket effects, *Intangib Quantification, Primary effects, Secondary effec

The author states his belief that benefit-cost an sis, with its considerable expense, great effort risk of misleading results is worthwhile despite fact that governmental decisions regard resource development are essentially polit rather than economic. This type of anal restrains the abuse of economic arguments in political process. It also increases scientific derstanding of the physical and social problems volved in resource development. Benefit-cost a ysis can make use of extramarket benefits and c through numerous indirect means. It also can used in considering indirect as well as di benefits and costs stemming from and induced public resource development project. It is supe to the use of willingness to pay as an econo criterion. The author states his belief that, in a tion, there are potentiabilities for improvem that may render the practical influence of ben cost analysis considerably more potent. Since w resource studies have relied heavily on benefit-c studies this article has relevance to w researcher. (Murphy-Rutgers)
W69-09006

CONSUMER ATTITUDES, BUYING INT TIONS AND EXPENDITURES: AN ANALY OF THE CANADIAN DATA,
Michigan Univ., Ann Arbor; and Bank of Can Ottawa (Ontario)
Harold T. Shapiro, and Gerald E. Angevine.
The Canadian Journal of Economics, II, No 230-249, May 1969. 20 p, 3 fig, 8 tab, 2 append

Descriptors: *Expenditures, Income, Attitu Forecasting.
Identifiers: *Consumer attitudes, *Buying in tions, Index of Consumer Sentiment, Index of C sumer Mood, Automobile expenditures, Dur good expenditures, Services

simplest Keynesian consumption function, e acts as a proxy for both the ability to buy complex of attitudinal and expectational vari- of households concerning jobs, employment, usiness conditions in the months and years In general, however, variations in consumer es will not be solely dependent upon current and recent changes in income but also upon a ange of other factors which are subject to in- dent variation. If these various factors could asured and summarized to form a single vari- A) that would represent the current buying e of the entire consumer sector, such a mea- might significantly improve our ability to st short-run variations in consumer expendi- The purpose of this study is to analyze the ness of a measure of consumer attitude, the of Consumer Mood, in forecasting consumer ditures in Canada. Section I describes the uction of such an index. Section II tests the ness of this index in predicting. Sections III employ various time series tests to compare lative power of the attitude index, buying in- ns data and fluctuations in stock prices in sting consumers' expenditures. Such an at- variable may prove to be significant in sting both domestic and industry consump- f water in water demand studies. (Loeb-Rut-

09007

Cost Allocation, Cost Sharing, ricing/Repayment

CIPAL WATER SUPPLY FOR NONRE- NTS: RECENT DEVELOPMENTS AND A ESTION FOR THE FUTURE,
ado Univ., Boulder.
n L. Sax.
al Resources Journal, Vol 5, No 1, May 1965. 1, 29 ref.

iptors: *Municipal water, *Judicial decisions, rates, Water supply, Water costs, Dis- natory pricing.
fiers: *Suburban water.

ugh there is a growing acceptance of the doc- hat a city should provide neighboring suburbs vater on reasonable and nondiscriminatory courts continue to rule for the defendant ci- onresidents urge that a differential charge is unreasonable and therefore unlawful. Cities uce evidence which might justify differential There are valid claims, such as cases where axes finance the water system, and cases outside areas are sparsely settled and thus higher costs of maintenance and service. are also claims which win cases but do not nsate for inflated suburban water rates. It is ded that plaintiffs must cease limiting them- to the discrimination per se argument and orce a specific analysis of the rate differential e. A workable solution may be to impose defendant cities a duty of compiling and ing the cost data for each item which is util- determining rates. Such a rule does not shift ditional burden of proof; it merely particu- the burden of production. Also, the city have this information at hand, if its rate s are in order. (Gossen-Chicago) 8630

JTION CHARGES, WASTE ASSIMILA- CAPACITY INVESTMENT, AND WATER ITY: THE PUBLIC COSTS OF A PUBLIC
tate Univ., Columbus. Dept. of Economics.
len Boyd.
Project No A-010-OHIO. Work supported ls from OWRR, Dept of Interior. Ohio State ater Resources Center Rep, Jan 1969. 89 p, tab, append.

ptors: *Water pollution control, *Optimiza- Systems analysis, Economics, Costs, Low-flow augmentation, Reaeration, Oxygen demand, Taxes, Cost analysis.
Identifiers: Pollution abatement costs.

A systems analysis study was made of the relationship between pollution-charge tax income and the costs of augmentation of waste assimilative capacity, with both set to maximize benefits to rivers. Parametric cost functions for several waste treatment technologies are derived. It is concluded that low-flow augmentation coupled with optimal-level pollution changes will probably generate substantial financial surpluses, while artificial aeration will probably break even or generate a small deficit. (Knapp-USGS)
W69-08751

METHODS FOR CALCULATING THE COST OF DEVELOPING GROUND-WATER RESOURCES IN APPALACHIA,
Geological Survey, Charleston, W.Va.
For primary bibliographic entry see Field 02F.
W69-08764

COMPARATIVE COST EVALUATION OF DESALTED WATER SUPPLY VERSUS ALTERNATIVE FRESH WATER SUPPLY FROM A CONVENTIONAL SOURCE,
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 03A.
W69-08868

COST OF PUMPING IRRIGATION WATER IN TEN NEW MEXICO COUNTIES,
New Mexico State Univ., University Park. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 03F.
W69-08963

NATURAL-GAS-PIPELINE RATE REGULATION: MARGINAL-COST PRICING AND THE ZONE-ALLOCATION PROBLEM,
Laurence C. Rosenberg.
Jour Pol Econ, Vol 75, No 2, p 159-168, Apr 1967. 10 p, 3 fig, 4 tab, 9 ref.

Descriptors: *Utilities, Natural gas, Peak loads, Consumptive use, Variable costs.
Identifiers: *Regulatory policy, *Federal Power Commission, *Zone-cost-allocation method, optimal rate structure, Atlantic Seaboard formula, Capacity costs.

Criticism of regulatory policy of gas and electric utilities is often based on a finding that rate-making procedures tend to cause prices to deviate from marginal costs such that peak-period users pay too little and off-peak users pay too much. Federal Power Commission (FPC) regulation of natural-gas pipelines may also result in a similarly defective rate structure, the result of which may be to inhibit utilization of existing plant and to construct too much capacity. The two necessary conditions to make such a criticism have not been adequately established, that is, what is an optimal rate structure and how do current practices deviate from it. For a sufficient analysis, peak-and off-peak period pricing must be considered along with the zone-cost-allocation problems that arise from the fact that pipeline customers are located at varying distances from the source of gas and are charged according to the zone to which they are assigned. This article extends the theory of peak-responsibility pricing based on marginal costs to include zone allocation and to evaluate FPC policy for its consistency with the results of the theoretical analysis. Both the peak-load pricing and zone allocation aspects of this article would have relevance for water pricing policy in certain locations. (Sokoloff-Rutgers)
W69-08983

SIDE EFFECTS OF RESOURCE USE,
Electricity Council, London (England).
Ralph Turvey.
IN Environmental Quality in a Growing Economy, Baltimore, The Johns Hopkins Press, 1966. p 47-60, 14 p, 12 ref. Henry Jarrett, Editor.

Descriptors: *Economic justification, *Resource allocation, *Pollution, *Economics, *Technology, Taxes, Fisheries, Fish stocking, Subsurface water, Water supply, Prices, Costs, Land, Wells, Rivers, Sewage, Marketing, Roads, Powerline carriers.
Identifiers: *External diseconomies, *Regulation, *Calculations, Water reserves, Criterion, Temperature, Brickworks, Noise.

The article is concerned with a consideration of the neglected side effects of the use of natural resources on the quality of the environment. These side effects, or external economies and diseconomies, are relationships in the market other than those between buyer and seller. To illustrate this concept, seven examples are used which give both reciprocal and/or unidirectional impacts. These examples are fisheries, traffic flow, wells, jet noise, river pollution, visual aesthet ics and cattle poisoning. Where side effects are involved, as in these cases, the market mechanism alone may not produce the best possible allocation of resources. Reduction of the adverse consequences of external effects is a multi-dimensional problem: who should do what and how much. To answer this, the economic criterion used should be that the present value of the monetary measure of all gains from modifying activities less the present value of the monetary measure of all losses from these modifications be maximized. Regulation is another possible solution, as is a tax. At any rate, each case must be individually weighed, alternatives should be considered, and it should be remembered that questions of fairness require legal or political decisions. (Murphy-Rutgers)
W69-08989

THE SOCIAL TIME PREFERENCE DISCOUNT RATE IN COST-BENEFIT ANALYSIS,
Nuffield Coll., Oxford (England).
M. S. Feldstein.
The Economic Journal, Vol 74, No 294, p 360-379, Jun 1964. 20 p, 16 ref.

Descriptors: *Cost-benefit analysis, *Costs, Interest rate, Discount rate, Capital, Income, Demand, Government, Consumption, Fixed costs, Economics, Rates.
Identifiers: *Social time preference, *S T P rate, Capital market, Rate of return, Opportunity costs.

In this paper the author finds that the social time preference function cannot be derived on the basis of existing market rates, but must be administratively determined as a matter of public policy. As a subtopic in the area of benefit-cost analysis this article, with its concentration on the problems of public goods, is of particular interest to the water resource planner. The article examines the characteristics of the social time preference (S.T.P.) function, its relation to the S.T.P. rate and the movement of the S.T.P. rate through time. The article concludes with several recommendations for more effective decisions in the public investment area. (Murphy-Rutgers)
W69-08992

ECONOMIC EVALUATION OF WATER, PART IV AN INPUT-OUTPUT AND LINEAR PROGRAMMING ANALYSIS OF CALIFORNIA WATER REQUIREMENTS,
California Univ., Berkeley.
E. M. Lofting, and P. H. McGauhey.
Water Resources Center Contrib, No 116. August 1968. WRC Project W112-1B-65/69. OWRR No B-017-Cal. 187 p.

Descriptors: *California, *Water resources development, *Water demand, *Input-output analysis, *Linear programming, *Resource allocation, Cost-benefit analysis, Economic feasibility, Financial feasibility, Taxes, River basin development, Leontief models, Dynamics, Regional analysis, Capital, Constraints, Discount rate, Export, Water utilization, Fresh water.

Identifiers: *Public investment programs, *General equilibrium analysis, Empirical data, Final demand, Sector, Interindustry transactions, Dual problem.

In scope this study considers both the methodology and the limitations of the linear programming model as a planning and decision-making goal. An interindustry model for the State of California is constructed based on national and secondary data sources for the year 1958. The model is aggregated to a representative number of sectors for which water-use data could be obtained and formulated as a linear programming model for which typical fresh water withdrawal constraints could be changed parametrically. A time series for Gross State Product was developed for 1940 to 1966 in 1958 constant dollars and growth projections were made to the year 1990. Ranges of final demands for the model were set and solutions obtained so as to maximize Value Added given different levels of fresh water availability. Minimal levels of water required were determined and estimates made that would satisfy the specified demands fully. The dual solutions of the linear program were noted as the water constraints were changed and the shadow prices for water were determined for different levels of water availability. (Sokoloff-Rutgers)
W69-08994

ROAD PRICING,
London School of Economics and Political Science (England).
A. A. Walters.
De Economist, Vol 116, No 5, p 545-60, Sept/Oct, 1968. 17 p, 1 tab.

Descriptors: *Pricing, Gasoline, Taxes, Capital costs, Financing, Rent, Queuing theory, Urbanization.
Identifiers: *User charges, *Congestion costs, *Social costs, Market forces, Scarcity, Traffic level, Road space, Subsidies, Public transport.

Among the main problems in the public sector of the economy are those of road congestion on the one hand and under-utilization of roads on the other. This is partly a consequence of inefficient price policies for the use of roads. But road pricing involves many technical and distributional problems. A preliminary survey of the effects suggests that quite simple road pricing systems, such as a differentiated urban-rural license fee, may be a most efficient way of introducing road pricing. Tolls on critical access points may be another efficient way of introducing congestion charges. At the same time it is important to attempt to reduce charges on uncongested roads, and this is especially necessary for developing countries. A preliminary survey of the effects of such a rearrangement of road taxation suggests that there would be no market redistributional effects. But much more work is required on this aspect of road pricing. This analysis has some application to pricing and taxation policy for water resources, especially in cases where there are many competing demands on an inadequate fixed supply, that is not easily augmentable. (Sokoloff-Rutgers)
W69-08995

COST AND REVENUE ASSOCIATED WITH INCREASED SALES OF TVA POWER,
Missouri Univ., Columbia.
Richard L. Wallace.
Southern Econ Jour, Vol XXXIII, No 4, p 526-534, April 1967. 9 p, 5 tab.

Descriptors: *Tennessee Valley Authority Project, *Power marketing, Peak loads, Transmission (Electric), Alternative costs, Pricing, Economies of scale, Economic efficiency, Resource allocation, Investment, Interest rate.
Identifiers: *Capacity costs, *Energy costs, Social cost, Wholesale rate structure, Asset life, Stream plants, Production costs, Annual load growth, Revenue.

The purpose of this paper is to determine whether TVA's wholesale rates are consistent with the goal of efficient resource allocation. Since this goal requires prices that reflect the social cost of supplying additional power, the costs of providing for annual load growth, as it has occurred under TVA's rate structure, are compared to the increases in revenue for which the additional power is supplied. Cost and revenue estimates are compared for overall annual increases in TVA load and for annual increases in the loads of each of the three classes of TVA customers (municipal and cooperative distributors, 36 large industrial firms served directly by TVA, and other federal agencies). In addition, the cost imposed on TVA when a new all-electric home is added to a distributor's lines is compared to the increase in revenue received by TVA from the distributor for power resold to this customer. This comparison is made because of the important contribution of electric heat to the system peak. This article may have some applicability in deciding pricing policies for water resources. (Sokoloff-Rutgers)
W69-08996

TRANSACTION COSTS, RESOURCE ALLOCATION AND LIABILITY RULES--A COMMENT,
Yale Univ., New Haven, Conn.
For primary bibliographic entry see Field 06E.
W69-09000

SOME POLITICAL ASPECTS OF LARGE SCALE INTER-BASIN TRANSFERS,
Wisconsin Univ., Madison.
I. K. Fox
Presented at the Annual Meeting of the American Association for the Advancement of Science, Dallas, Texas, December 30, 1968. 22 p.

Descriptors: *Inter-basin transfer, Negotiation, Cost allocation, Economics, Water resources development.
Identifiers: Political processes, Public policy, Bargaining, National interest.

This paper characterizes the political processes through which inter-basin transfer decisions are made and identifies some of the basic public policy issues in this area. The political process involves negotiation and bargaining among groups--some with interests primarily in the region of water origin, some with interests primarily in the region receiving the supply, some with a major interest in development programs, and some with a national interest. These groups adopt strategies and make demands in accord with their respective interests. In view of the high cost of water transfers, public action requires a strategy which achieves an acceptable distribution of costs and returns among the bargaining groups, a unified effort on the part of those who will benefit, and avoiding behavior and plans that will needlessly arouse opposition. Three major policy issues are identified: (1) Will realistic alternatives for meeting demands for water and water services be examined in the bargaining process; (2) Will all groups affected by a proposed transfer be represented in the decision with regard to a proposed transfer; (3) How will the costs of the transfer be shared. (Author)
W69-09025

6D. Water Demand

SOME ASPECTS OF WATER SUPPLY AND SEWERAGE IN ROMANIA (ROMANIAN),
State Water Committee, Bucharest (Rumania).
For primary bibliographic entry see Field 05D.
W69-08962

STATISTICAL APPENDIX,
Nevada Univ., Reno. Div. of Agricultural Economics and Education; and Nevada Univ., Reno. Max C. Fleischmann Coll. of Agriculture
For primary bibliographic entry see Field 04C.
W69-08964

THE DEMAND FOR RECREATION OKLAHOMA,
Oklahoma State Univ., Stillwater. Dept. of A tural Economics.
John G. McNeely, Jr.
First annual Oklahoma Outdoor Recreatio ference Proceedings, p 1-9, Mar 9 and 10, 1 p, 1 fig, 1 map, 3 tab.

Descriptors: *Recreation demand.
Identifiers: *Oklahoma.

Outdoor recreation is no longer a free good ture, but has a price due to an ever increasi mand for it. Some of numerous factors tha played a role in increasing the demand for r tion are rising incomes, increased leisure tim creasing population, and better roads highways. Projections of national population per capita disposable income, average work average paid vacations, and miles travelle capita are given. Then projections of the de for recreation in Oklahoma are made. Some in which the increasing demand may be m discussed. (Grossman-Rutgers)
W69-08965

ECONOMIC IMPACT OF RECREATI DEVELOPMENTS IN THE RESERVE RA DISTRICT,
New Mexico State Univ., University Park. De Agricultural Economics.
For primary bibliographic entry see Field 04C
W69-08967

ECONOMIC DEVELOPMENT THRO PLEASURE AND PROFIT,
Oklahoma State Univ., Stillwater. Dept. of A tural Economics.
For primary bibliographic entry see Field 04C
W69-08971

THE WATER CRISIS IS PRESENT,
Development and Resources Corp., Sacran Calif.
William E. Warne.
Natural Resources Journal, Vol 9, No 1, p Jan 1969. 10 p.

Descriptors: Irrigation, California, Colorado Basin, Water quality, Surface waters, Storage lutants, Inter-basin transfers, Low-flow augn tion.
Identifiers: *Water crisis, *Clean Water *Quality-quantity conflict, Water diversion, Water Resources Control Board, Mineral con

The water crisis is present in California, it is Colorado River Basin, and it is found in most river basins across the nation. The federal g ment took action that revealed the presence water crisis. Namely, under the Clean Water required the states to establish quality standa interstate streams. In California, the former Water Pollution Control Board wrestled for s years with the problem of fixing statewide c for water pollution control, but it could not about much agreement and its action w adequate. When the Board considered the dards it would adopt for the Delta, the D Water Resources successfully contended th adoption of too high a standard for the con salinity, would tend to disrupt water proje ready adopted. Acceptable water quality sured by salinity, cannot be maintained in the without conflict with surface water storag diversion projects of utmost importance state. It is the subtle changes wrought by u reuse of limited water supplies that is the pr in California, changes that are measured laboratories in the mineral content of the re ing water. (Sokoloff-Rutgers)
W69-08973

NAL DISECONOMIES, CORRECTIVE , AND MARKET STRUCTURE,
nia Univ., Los Angeles.
M. Buchanan.
Econ Rev, Vol LIX, No 1, p 174-177, Mar p, 1 fig, 5 ref.

tors: *Welfare, *Water pollution control.
ers: *Externalities, *Corrective taxes, etitive structures, *Theory of second-best, n policy norms, Pareto efficiency, Production.

ox Pigovian analysis suggests the levy of in situations of external diseconomies. nists have recently demonstrated some of iitations on this device. They have not out one elementary requirement: the levy rrective tax may reduce efficiency in non-itive market structures. This point is ed geometrically, and provides a singularly xample of the principle of second-best situa-Since external diseconomies are frequently in analyzing water resource requirements icle has relevance to water pricing and allo-studies. (Sokoloff-Rutgers)
8978

ETITIVE EQUILIBRIUM: EXISTENCE PPROACH,
hool for Social Research, New York.
eisser.
Pol Econ, Vol 76, No 6, p 1199-1208, ec 1968. 10 p, 18 ref.

tors: *Mathematical models, Capital, Inate.
ers: *Competitive equilibrium, *Long-run rium, Natural prices, Inputs, Productive ser-quilibrium path, Converging series, Techni-gress.

lysis of Walras shows that long-run equilibri-is sense can only be attained in very special ns, if at all. As to Alfred Marshall, an unfor-preoccupation with marginal relations ex-the mathematical closing of his system. er, he did suggest what is commonly called a c relation, the inter-temporal price relation, as proven to be worthwhile investigating. is in mind the author disaggregates the ian model as far as possible and then in-s the inter-temporal relation, obtaining a which he believes is more realistic than Wal-d yet one which leads as far (except for etermination) as the Laussane model. In e its dynamic component would allow one out whether it converges and, if so, to the long-run equilibrium toward which it es. Stationary price expectations make this system dependent on the values of ers--the quantity of money, 'aggregate' tive yield and the conventional interest ne of which is likely to remain the same. task should not be attempted since it is that because of technical progress the economy diverges at a rate between 3-4.5 per year. Macro-equilibrium behavior is a n that is assumed in many projections of for water resources. The validity of this as-n should affect the validity of these projec-okoloff-Rutgers)
999

USE IN SOUTH FLORIDA RE-ES--A SOCIOLOGICAL PERSPECTIVE,
Univ., Gainesville.
ubat, Lillian Lei, and George Watkins.
Completion Report, OWRR Project A-010 68. 180 p, 8 fig, 47 tab, 97 ref, 3 append.

ors: *Florida, *Water supply, *Domestic Water requirements, *Correlation analysis, on, Organization, Water users.
s: *Sociological research, *Residential Scale of attitudes, *Community action, nnaires, *Mean water use curve, *Demo-haracteristics.

This nation required only 40 billion gallons of water daily in 1900, but by 1965 it required 360 billion gallons a day, an increase of more than threefold in the use per capita. As the standard of living increases it is expected that the strains on the adequate and high-quality water supply will increase. Literature on community action can be combined with those few studies which pertain to watershed acceptance patterns among populations concerned, in order to supply the basis for social science analysis. Such a combination may provide enough data to suggest some policy recommendations regarding water resource conservation for specific communities. The purpose of this study is to determine what relationships there are between water consumption in residential areas, as compared with certain designated demographic and social characteristics of the population. The study aims at discovering some set of basic attitudes to water consumption, conservation and waste with the goal of unraveling the underlying values about water as a commodity. (Sokoloff-Rutgers)
W69-09002

GROUNDWATER--A NEGLECTED RESOURCE,
Geraghty and Miller, Port Washington, N.Y.
James J. Geraghty.
Jour American Water Works Assoc, Vol 59, No 7, p 820-828, July 1967. 9 p, 5 fig, 1 ref.

Descriptors: *Groundwater, *Geologic formations, Coastal plains, Pumping, Natural recharge, Salinity.
Identifiers: *Natural reservoirs, Freshwater reserves, Utilization, Temperature variations, Wastes contamination.

When the Pilgrims first landed on these shores, this nation's natural underground tank held an estimated 47 bil acre-ft of ground water. As of 1955, we had used up only 0.2 percent of this immense quantity. At the present rate of depletion the quantity of ground water known to be present in our aquifers would last for another 7,800 years. To make an estimation of the availability of groundwater for a particular region is a difficult matter, because this resource is completely hidden from view. The only way to determine how much groundwater can be pumped in a given region is to undertake careful studies of the geology, the natural rate of replenishment from rainfall, the ability of the formations to transmit water to wells, and similar factors. Often, such investigations call for test drilling and the carrying out of geo-physical surveys. Probing the earth in this way can be expensive, but there are no shortcuts, and as groundwater is one of our vitally important resources, the results are almost always well worth the investment. (Sokoloff-Rutgers)
W69-09004

6E. Water Law and Institutions

MAYNARD V HAWLEY (SUIT TO ENJOIN DRAINAGE OF WATER UPON LAND).
For primary bibliographic entry see Field 04A.
W69-08634

POLICIES FOR WATER LAW: PROPERTY RIGHTS, ECONOMIC FORCES, AND PUBLIC REGULATION,
Wyoming Univ., Laramie.
Frank J. Trealease.
Natural Resources Journal, Vol 5, No 1, May 1965. p 1-48, 141 ref.

Descriptors: *Legislation, Optimization, Economics, *Public rights, Cost-benefit analysis, Water utilization, Intangible benefits, Intangible costs, *Water rights, Regulation, Appropriation.
Identifiers: *Legislative policies, Property rights.

The paper analyzes the policies that lie behind water laws. Section I discusses the ultimate goal for water resource law - maximization of benefits. The suggested means for achieving this goal are property rights, economic forces, and public regulation. Section II describes a system in which property rights could maximize benefits, and discusses the acquisition of rights, the difference between public and private cost-benefit analyses, intangible costs - and benefits, duration of the water right, and the need for clear description of the right. Section III discusses economic forces. It considers changes over time in uses of water and changes from private to public use. Section IV, on public regulation, prevention of cost - shifting, and devices for protecting public interests. Present water law has many shortcomings. Many aspects of western water law prohibit optimal use of water. Maximum development is impeded by both western and eastern laws restricting the place of use. There are paper rights representing unused appropriations which may upset valuable existing uses. Some western laws tie water to land and prevent its movement on the market to higher uses. (Gossen-Chicago)
W69-08635

UNITED STATES GYPSUM CO V MYSTIC RIVER BRIDGE AUTH (ACCESS TO DOCKS BY WATER).

106 NE 2d 677-684 (Mass 1952).

Descriptors: *Docks, *Navigable waters, *Bridges, *Massachusetts, Eminent domain, Condemnation, State governments, Rivers, Riparian rights, Damages, Remedies, Judicial decisions, Bridges, Compensation, Bridge construction, Piers, Legal aspects.

Petitioner manufactured plaster board in a plant bordering a navigable river. Raw materials were transported by water to petitioner's plant. The respondant, Mystic River Bridge Authority, was created by statute to build a bridge for vehicular traffic. The authority was authorized to locate the bridge, acquire land and easements, and contract for erection of the bridge. In erecting the bridge, a pier was placed in the bed of the river approximately eighty feet offshore of the petitioner's wharves. This pier severely hampered petitioner's operations and decreased the value of his land. In a proceeding on the petition for assessment of damages, the jury awarded $262,950. On appeal, the court held that when an owner of a wharf on land bordering an arm of the sea has navigation between his property and the sea destroyed by the authorized construction of a bridge, neither the Constitution nor the common law required compensation. However, the legislature could choose to extend compensation to individuals who might suffer serious damage and who otherwise would receive no compensation. The legislature had authorized such compensation in the bill authorizing the bridge. (Gabrielson-Fla)
W69-08636

COMPREHENSIVE STATE PLANNING AS A FRAMEWORK FOR WATER RESOURCE DEVELOPMENT,
Arthur Ortiz.
In Thirteenth Annual Water Conference, Water for New Mexico to the Year 2000 and 2060, March 1968. p 48-58, 8 ref.

Descriptors: *New Mexico, *State jurisdiction, *Water resources development, Research and development, Area redevelopment, Long-term planning, Short-term planning.
Identifiers: *Planning districts, Rural-urban conflicts, Comprehensive planning.

The major function of the State Planning Office of New Mexico has been the development of a Statewide Resources Development Plan. Its first phase consisted of an inventory of the various resources of the state, with the resultant publication of approximately 40 studies. Resource availabi lity, development and related problems were analyzed, includi ng state water resources, water law and agricultural land and water. The second phase and current one consists of three aspects: (1) developing new techniques for handling emerging problems; (2) formulation of a Statement of Goals

and objectives to guide the state's overall comprehensive development; (3) provide direction to the programs of state agencies in terms of goals and objectives. The State Planning Office programs can be viewed most usefully as part of a planning process. The state has been divided into districts for planning and development purposes. Cultural patterns and major economic activities vary widely throughout the state and present opportunities and problems which are unique to particular regions. Each district may establish a regional planning commission, as permitted by New Mexico statutes. In terms of water resources development in the near future, the direction taken by the state's economy will be a critical factor. Improvements in the performance of state government should also promote effective water development policies. Finally, the creation of these planning and development districts also should yield benefits with respect to water development policies. As problems are resolved cooperatively on an area-wide basis, it is anticipated that conflicts between rural and urban interests over water utilization will lessen. (Starr-Chicago)
W69-08638

DITCHES AND DRAINS.

Minn Stat Ann secs 106.491 to 106.581 (1964).

Descriptors: *Minnesota, *Drains, *Ditches, *Drainage systems, Drainage engineering, Local governments, Drainage programs, Flood control, Sewers, Culverts, Bridges, Conduits, Outlets, Laterals, Pipes, Sewage disposal, Tiles, Obstruction to flow, Administrative agencies, Interstate, Legislation, Legal aspects, Cities.

If any ditch is obstructed by a bridge or culvert with an insufficient waterway opening to allow proper flow, the party responsible for such obstruction shall be required to remove it. Any improvement to a drain by tiling, enlarging or extending shall be preceded by a petition from affected property owners and a ruling by the county board or court based on a report of an engineer that the improvement is necessary. Improvements herein include only extentions downstream to a more adequate outlet or enlarging the original ditch system. Where a drainage system is likely to cause overflow of an existing drain, affected property owners may petition for improvement of the drain to eliminate the overflow. Persons owning land near an existing drainage system may petition for a lateral connecting the lands to the system. No private ditch may empty into a ditch authorized herein without permission of the county. The county or court ordering improvement of a drain may join with any adjoining state in the improvement if necessary. Any city desiring to use a public drainage system for a sewer outlet may petition the county controlling the drain. The petition shell have the approval of the state water pollution control commission. (Helwig-Fla)
W69-08738

MAINOR V HOBBIE (SUIT TO ENJOIN INTERFERENCE WITH FREE ACCESS RIGHTS TO BAY).
218 So 2d 203-206 (1st DCA Fla 1969).

Descriptors: *Florida, *Access routes, *Public rights, *Right-of-way, Recreation, Parks, Recreation facilities, Swimming, Bays, Legal aspects, Judicial decisions, Civil law, Real Property, Public rights.
Identifiers: Injunction.

This action was brought by subdivision property owners to enjoin other subdivision property owners from fencing in a portion of a street used for access to the bay and an irregular strip of land used as a recreation area. Plaintiffs based their access rights on a 1912 plat offering the contested area to the public for recreation and travel. Defendants claim that these access rights were cut off by a later suit to quiet title instituted by defendants' predecessors in title in 1951. The court, in finding for the plaintiffs, reasoned that a common-law dedication by the owner once accepted by the public was irrevocable by the owner or his successors in title except with the consent of the public and of those persons who had a vested right in the dedication. Looking at the 1951 suit to quiet title, the court ruled that since none of the plaintiffs herein were named or any public body having authority over streets were named, the quiet title suit did not cancel the alleged rights of the plaintiffs. (Logan-Fla)
W69-08741

OIL POLLUTION: PROBLEMS AND POLICIES,
For primary bibliographic entry see Field 05B.
W69-08752

SOME LEGAL AND ECONOMIC IMPLICATIONS OF SEA WATER INTRUSION--A CASE STUDY OF GROUND WATER MANAGEMENT,
California Univ., Davis. Dept. of Agricultural Economics; and California Univ., Davis. Water Resources Center.
For primary bibliographic entry see Field 02K.
W69-08768

WATER SALINITY PROBLEMS: APPROACHES TO LEGAL AND ENGINEERING SOLUTIONS,
Beardsley, Hufstedler and Kemble, Los Angeles, Calif.; and Colorado River Board of California, Los Angeles.
For primary bibliographic entry see Field 02K.
W69-08769

SUSQUEHANNA RIVER BASIN COMPACT; ORGANIZATION, POWERS AND DUTIES OF THE COMM'N.

Md Ann Code, art 96A:61, 62 (Supp 1968).

Descriptors: *Maryland, *Interstate compacts, *Interstate commissions, *River basins, Legislation, New York, Pennsylvania, Governments, State governments, Water policy, Water resources, Water resources development, Interstate rivers, River basin commissions, Water law, Rivers, Conservation, Water management, Basins, Diversion, Planning, Jurisdiction, Administrative agencies.
Identifiers: *Susquehanna River Basin Compact, Water allocation.

The Susquehanna River Basin Commission is created as an agency of the governments of the signatory parties to the compact. The commission's jurisdiction shall be within the limits of the basin. The general powers of the commission shall be to develop plans and projects relating to water resources and to promote policies for water resources conservation and management. It shall be the policy of the commission to use existing offices of government to effectuate the compact. The specific powers and duties of the commission relating to water resources conservation, development and management are set out. The commission and the signatory parties shall promote cooperation among the parties to the compact in effectuating its policies and purposes. The commission shall have the power to allocate water to and among the parties and to enter allocation agreements with other commissions or states. The commission shall have the power of review and approval of all non-exempt water projects within the basin. The commission shall approve any project not detrimental to the proper conservation, development or management of the basin's water resources. Any procedure for review and approval of water diversions shall be at public hearing, subject to judicial review. (Helwig-Fla)
W69-08772

NOSTDAL V WATONWAN COUNTY (DRAINAGE DISTRICT LIABILITY).

22 NW 2d 461-471 (Minn 1946).

Descriptors: *Minnesota, *Drainage
*Bridges, *Assessments, Water law, Judici
sions, Legal aspects, Ditches, Culverts, Re
State governments, Local governments,
Civil law.
Identifiers: *Negligence.

Plaintiff brought this suit to compel defen
remove an inadequate culvert or bridge wh
part of a drainage project and to replace it
adequate culvert or bridge. Plaintiff owne
located within a certain area of a judicial dit
amount of $700 was awarded to defendant
struct a bridge over said ditch to accomm
county road. Twice defendant negligentl
structed the culvert which resulted in the a
lation of mud and dirt which rendered the d
effective. Plaintiff and other landowners in t
were subsequently assessed for costs resultin
the cleaning of the ditch. Plaintiff then so
compel defendant to remove and replace
adequate culvert with an adequate one and
the costs of cleaning the drainage ditch. Th
denied the relief sought. The court based i
sion on the fact that the county is an arm
state and thus immune from negligence sui
court indicated that plaintiff might have be
cessful had he pursued relief on the theory t
fendant was benefited by the ditch an
sequently subjected to the damages and b
provisions in the drainage law which dete
the method for assessment. (Holt-Fla)
W69-08774

**UNITED STATES V TWIN CITY POWER
PANY (CONDEMNED LAND'S VALU
WATER POWER SITE PROPER ELEME
CONDEMNATION VALUE).**

215 F 2d 592-601 (4th Cir 1954).

Descriptors: *Federal jurisdiction, *Con
tion, *Condemnation value, *Hydroelectric
Compensation, Pondage, Judicial decision
perty values, Electric power production
Damsites, Federal Power Act, Legislation,
control, Navigable rivers, Legal aspects
demnation, Ownership of beds, Federal
ment, United States, Hydroelectric power.

In connection with water power and flood
development the United States, under th
merce clause, moved to condemn lands ow
defendant power company. The United Sta
pealed the District Court's ruling denying
tions to strike portions of answers asserting t
condemned land's potential as a hydro-
powersite constituted a permissible element
compensation. The court of appeals affirm
held that in arriving at just compensati
private property all elements entering in
value of the property must be taken into cor
tion. The land in question was bought by the
dant as a water power site and the United
condemned it for the same purpose. The
and most profitable use for which land is ad
and likely to be needed in the near future
considered. The absolute ownership and i
private property is not varied by the fact t
land borders on a navigable stream. An
taken which lie outside the bed of the strea
be compensated for, even when the govern
purpose is the improvement of navigation, u
commerce power. While it was true that
jacent owner does not own the water pow
of a river, it is also true that the governme
not have any servitude over such adjacen
(Blunt-Fla)
W69-08775

**RICE HOPE PLANTATION V
CAROLINA PUBLIC SERV AUTH
(DAMAGE FROM SALT WATER INF
TION AS A TAKING).**
59 SE 2d 132-146 (SC 1950).

Descriptors: *South Caroli na, *Eminent
*Streamflow, *Encroachment, Saline water

n rights, Rivers, Compensation, State
nents, Federal government, Federal Power
egislation, Wildlife, Hunting, Fishing, Ad-
ative agencies, Riparian land, Flooding,
water intrusion, Legal aspects, Diversion,
es, Remedies.

f corporation owned a large tract of land
ng on two rivers. Defendant Public Service
ssion constructed a dam on one of the rivers
laintiff's property causing a large part of the
flow of the fresh water to be diverted. Salt
rom the ocean infiltrated the streams and
decreasing the property value. The water
nally overflowed when water was released
the dam allowing saline water to flood the
hich caused damage. Plaintiff brought suit
ght recovery under 4 theories: (1) compen-
or property taken; (2) a cause of action in
) a cause of action under the Federal Power
d (4) a cause of action in quasi-contract.
preme court held that the Commission as a
corporation was immune from suits ex delic-
the Federal Power Act did not impose upon
ee a new liability above what it inherently
t there was no factual basis for plaintiff's al-
of unjust enrichment and that there was no
in quasi-contract. The court further held
e only theory under which plaintiff could
was just compensation for property taken.
-Fla)
776

SCIOTO-SANDUSKY CONSERVANCY
ICT (FLOOD CONTROL DISTRICTS).
2d 51-54 (Ct App Ohio 1952).

tors: *Ohio, *Flood control, *Levees,
Reservoirs, Multi-purpose projects,
tion, Judicial decisions, Legal aspects,
Ohio River, Watersheds, Engineers, Public
s, Public health, Drainage, Lake Erie,
ng, Federal government.
ers: *Flood district, Scioto River, Sandusky

cioto-Sandusky Conservancy District was
hed by a general legislative act. The district
its official plan, certain persons objected,
pecial hearing was held. The court conduct-
hearing approved the plan after certain
nents were made. This ruling was appealed
bjectors. Most of the objections concerned
n dam and reservoir in two specific coun-
respect to these projects, the official plan
or them to be financed by federal funds.
jectors claimed that during the interim
the plan's adoption and the federal
nent's action, there will be a long period of
inty that would be detrimental to the per-
ected. The court held that since the purpose
lan was to provide for the health and wel-
he public, it must be liberally construed and
this contention as mere conjecture. The
id that a few must necessarily be incon-
ed so that a benefit may accrue to many.
rt approved the official plan as amended.
-Fla)
777

ONWEALTH V SONNEBORN (INDUS-
POLLUTION).

uper 493, 66 A 2d 584-587 (1949).

ors: *Pennsylvania, *Industrial wastes,
pollution sources, Water pollution control,
ollution, Water pollution effects, Water
abatement, Rivers, Lagoons, Streams,
l wastes, Public helath, Fish toxins,
Aquatic animals, Legal aspects, Judicial
s, Administrative agencies.
rs: Sanitary Water Board.

monwealth of Pennsylvania instituted this
gainst the defendants for illegally discharg-
strial wastes, injurious to animal and aquatic life, into Bear Creek and the Allegheny River. The defendant's plant discharged chemical wastes into a lagoon and then cut the bank or dike of the lagoon and drained the waters into the creek and river. By statute, any discharge that is injurious to aquatic life shall be unlawful and a nuisance. The defendant contended that the action would not be considered unlawful unless the Sanitary Water Board determined it as such. The court determined that the defense was affirmative and could only be relied upon if the Board had determined the discharges necessary because of the war. The defendant had made no effort to get a determination by the Board and could thus not rely on this defense. (Shevin-Fla)
W69-08778

NATIONAL BY-PRODUCTS, INC V UNITED STATES (GOVERNMENTAL TAKING BY FLOWAGE EASEMENT).

405 F 2d 1256-1275 (Ct Cl 1969).

Descriptors: *Eminent domain, *Easements, *Floods, *Flood protection, Levees, Floodprofing, Compensation, Federal government, Historic flood, Maximum probable flood, Flooding, Contracts, Banks, Damages, Streams, Streamflow, Riparian rights, United States, Judicial decisions, Legal aspects.
Identifiers: *Flowage easement.

Plaintiff owned property on the south bank of a stream. Defendant, United States, built a levee on the north bank to prevent the flooding of a military installation. Plaintiff alleged that a contract with defendant had been made to build a corresponding levee on the south bank. Plaintiff further alleged that because the government had not built the levee on the south bank, a flowage easement had been taken when plaintiff's land was flooded. He sought compensation for the alleged easement. The court held that the parties had entered into no contract for construction of a levee. It further held that even though the government can appropriate land by flooding, not all flooding is a taking. Plaintiff had to show that the flooding was induced or would inevitably recur and was not merely occasional flooding. The government is not liable for consequential damages arising from its lawful activities. Here defendant did not knowingly induce floods thereby taking flowage easements which would entitle plaintiff to compensation nor could plaintiff show permanent damage from recurring floods. (Helwig-Fla)
W69-08779

TRANSCONTINENTAL GAS PIPE LINE CORP V MR CHARLIE (DAMAGE TO SUBMERGED GAS PIPELINE).

294 F Supp 1025-1034 (E D La 1968).

Descriptors: *Pipelines, *Oil industry, *Drilling, *Law of the sea, Fuels, Natural gas, Oilfields, Oil, Oil wells, Locating, Subsurface mapping, Surveys, Right-of-way, Wells, Judicial decisions, Mines, Navigable waters, Legal aspects, Damages.
Identifiers: *Barges, Major-Minor Fault Doctrine.

Plaintiff owned a gas pipeline laid across the floor of the Gulf of Mexico. The permits and rights-of-way for the pipeline had been properly secured and the location charted. The line ran across a petroleum drilling field. Defendants, an oil company and its drilling contractor, secured an oil and gas lease from the United States. The oil company located the position for a well and began drilling operations. The drilling was accomplished by means of a submersible drilling barge which rested on the ocean bottom. The barge's stabilizing skirts made contact with and damaged plaintiff's pipeline. The court held that the oil company was negligent to a major degree by selecting and locating the proposed well spot and not checking for existing pipelines in the area. The court allowed plaintiff to recover for the damages it its pipeline. (Helwig-Fla)
W69-08780

PETROLEUM PIPE LINES ACROSS FRESH WATER STREAMS.

NJ Stat Ann secs 58:10-24 to 58:10-35.4 (1966).

Descriptors: *New Jersey, *Pipelines, *Fresh water, *Underground storage, Administrative agencies, Administrative decisions, Pipe flow, Permits, Oil, Gases, Streams, Leakage, Remedies, Damages, Regulation, Legal aspects.
Identifiers: Judicial review, Penalties (Civil), Penalties (Criminal).

Extensive regulations govern the construction, operation, maintenance and removal of petroleum pipe lines across fresh water streams in New Jersey so as to prevent pollution via the escape of pipe line contents. Administration of these regulations is by the commissioners of water supply. Detailed notice of alleged violations of these regulations must be given by the commission and hearings held thereon. If the decision of the commission is against the pipe line user or owner, written specifications relative to remedying the defect are required to be submitted to the commission which can approve or disapprove them, substituting therefore its own specifications. Review of the commission's decisions can be had in the superior court. Violators of these regulations are subject to civil and criminal penalties. Regulations also govern the underground storage of petroleum products having as their purpose the prevention of pollution and protection of the public health, safety and welfare. Administration of these regulations is by the commissioner of the Department of Conservation and Economic Development. (Carruthers-Fla)
W69-08781

PETROLEUM PIPE LINES ACROSS FRESH WATER STREAMS.

NJ Stat Ann secs 58:10-24 to 58:10-35 (1966).

Descriptors: *New Jersey, *Pipelines, *Fresh water, *Underground storage, Administrative agencies, Administrative decisions, Pipe flow, Permits, Oil, Gases, Streams, Leakage, Remedies, Damages, Regulation, Legal aspects.
Identifiers: Judicial review, Penalties (Civil), Penalties (Criminal).

After defining 'commission', 'fresh water', and 'pipeline', the statutes prohibit construction, reconstruction, or removal of pipelines across fresh water streams except in a manner approved by the commission and in accord with the statutory provisions. If the commission feels that any pipeline's contents may leak into any fresh water it can hold a hearing with the pipeline owners, and shall give proper notice of the hearing and of its decision regarding danger of escape of pipeline contents. Within 15 days of this decision the owners are to submit specifications for reconstruction of such pipeline which specifications can be approved or substituted for by the commission. Reconstruction shall begin within 30 days of the notice of decision, or else the dangerous portion of the pipeline shall be removed at the owner's expense. For purposes of such removal the commission may freely enter upon lands. Any proceeding of the commission may be reviewed by the Superior Court. Where a ruptured or leaking pipeline causes injury to any fresh water, the commission may apply to the courts for immediate relief. A $500 a day fine is the penalty for pipeline construction in a non-approved manner, with a remedy in damages available to the commission for leakage even if pipelines are constructed in an approved manner. (Carruthers-Fla)
W69-08782

UNDERGROUND STORAGE OF GAS, PETROLEUM PRODUCTS.

NJ Stat Ann secs 58:10-35.1 to 58:10-35.4 (1966).

Descriptors: *New Jersey, *Pipelines, *Fresh water, *Underground storage, Administrative agencies, Administrative decisions, Pipe flow, Permits, Oil, Gases, Streams, Leakage, Remedies, Damages, Regulation, Legal aspects.
Identifiers: Judicial review, Penalties (Civil), Penalties (Criminal).

A permit is required from the Commissioner of the Department of Conservation and Economic Development for natural underground storage of gas and other petroleum products. This act is not applicable to installation of artificial underground storage tanks. The commissioner is empowered to prescribe rules and regulations to effectuate provisions of this act and may impose restrictions on any permit if he considers the same necessary in the public interest to protect the waters of the state Anyone violating the provisions of the act shall be guilty of a misdemeanor. Every application for a permit shall be accompanied by at least two copies of an accurate map prepared by a competent engineer or geologist showing the location, extent and depth of the proposed storage place and of all wells drilled or proposed to be drilled to such storage place. The commissioner shall determine whether the granting of any such application would be likely to endanger the public safety, health, and welfare and may use in such determination the written report of the Water Policy and Supply Council. (Carruthers-Fla)
W69-08783

IN RE SCHURZ (TITLE TO STREAM BEDS).

278 App Div 309, 104 NYS 2d 395-397 (1951).

Descriptors: *New York, *Stream beds, *Navigable waters, *Ownership of beds, Streams, Streamflow, Channel flow, Floods, Water levels, Tides, Mud flats, Slat marshes, Tidal effects, Damages, Judicial decisions, Legal aspects, Road construction, Relative rights, Beds under water, State governments.

The city of New York sought to acquire title to real property required for street construction. The contest involved rights to certain navigable waters. The claimants asserted title to certain lands which at times were under water. They maintained that the state, if wishing to acquire such lands for street construction, would be required to pay damages. The state contended that the title to the beds was reserved for the sovereign and therefore no damages should accrue. The court held that the grant of land to an individual by a sovereign which included a stream of water subject to the ebb and flow of the tide did not carry with it title to the stream bed. The land in question, the court said, consisted of salt meadows and sledge flats which were under water only at extreme floods and then only to the extent of a few inches. The court held that these flats could not be said to be reserved by the sovereign as part of the stream. The court held that the title to the land involved was in the claimants. The case was remanded so that damages could be awarded. (Shevin-Fla)
W69-08784

WATERSHEDS.
Minn Stat Ann, secs 112.34 to 112.49, 112.65 to 112.85 (1964).

Descriptors: *Minnesota, *Watershed management, *Water conservation, *Flood control, Watersheds (Basins), Erosion control, Legislation, Administrative agencies, Land tenure, Local governments, State governments, Surface runoff, Drainage, Drains, Recreation, Project planning, Dams, Rivers, Water law, Legal aspects, Water supply, Riparian rights, Contracts, Operation and maintenance, Construction, Planning, Financing, Drainage systems, Drainage programs, Public benefits.
Identifiers: *Watershed districts.

The Water Resources Board may establish watershed districts for the purpose of conservation and flood control. The districts shall be established upon petition of local governments or freeholders if the public welfare will be served by such action. Each such district shall be governed by district managers appointed by the Board. The managers shall have the power to do necessary acts to effectuate the purposes of this chapter and of the district. The managers shall plan projects, accept petitions from freeholders for projects, conduct hearings on these projects and carry out the construction of such projects as are deemed beneficial. Costs of the projects may be assessed against land benefited thereby. The managers of a district shall acquire, construct, operate and maintain drainage systems within the district and insure a proper drainage program. The managers may enter contracts of cooperation with other governmental entities for the benefit of the district. Rights of landowners shall not be impaired by projects of the district. No one shall be denied due process in any proceeding by the district. (Helwig-Fla)
W69-08785

ESTABLISHMENT OF WATERSHED DISTRICTS.

Minn Stat Ann, secs 112.34 to 112.411 (1964).

Descriptors: *Minnesota, *Watersheds (Basins), *Watershed management, *Water conservation, Erosion control, Flood control, Legislation, Administrative agencies, Land tenure, Local governments, Land management, Navigable streams, Surface runoff, Drainage, Recreation, Water supply, Hydrology, Beds, Banks, Riparian land, Public health, Public benefits, Land reclamation, Irrigation.
Identifiers: *Watershed districts.

The Minnesota Water Resources Board is empowered to carry out natural resources conservation and flood control by establishing watershed districts. Watershed districts shall be for the purposes of flood control, stream regulation and improvement, land reclamation, irrigation, providing for domestic, industrial and recreational water supply, promoting public health, improving drainage, controlling soil erosion and preserving stream beds and riparian lands. The local governments or the freeholders within a proposed district may petition the Board for establishment of a district. The Board shall hold a public hearing on the petition. If it appears a district would serve the public welfare, the Board shall establish such as a potitical subdivision, name managers thereof and establish a principal place of business. A district shall have perpetual existence and the power to do all authorized acts. A district may be terminated upon a determination, after a petition and hearing, that it no longer serves the public welfare or is no longer needed. (Helwig-Fla)
W69-08786

FUNCTIONS AND AUTHORITY OF WATERSHED DISTRICT MANAGERS.

Minn Stat Ann, secs 112.42 to 112.49 (1964).

Descriptors: *Minnesota, *Watersheds (Basins), *watershed management, *Project benefits, Contracts, Project planning, Water conservation, Erosion control, Drains, Ditches, Dams, Rivers, Legislation, Administrative agencies, Flood control, Land tenure, Navigation, Cities, Water supply, Wildlife, Public health, Projects, Hydrology, Administration, Management.

Upon the establishment of a watershed district in accordance with this chapter, the managers appointed thereto by the Water Resources Board shall meet, organize and conduct business as prescribed. The managers may make surveys and develop projects to accomplish the purposes of the district, enter necessary contracts, constuct and maintain ditches, drains, sewers and watercourses, maintain dams and like facilities, regulate use, acquire necessary property, purchase insurance, gather hydrologic information, tain, when directed, county drainage system trol water pollution, adopt rules and regulat effectuate district purposes and make all ne reports. The managers shall appoint an a committee to advise and assist in matters af district interests and may hire necessar ployees. They shall adopt an overall plan district. Freeholders may petition the manag projects. The managers shall study such p and proceed with construction if feasible an public interests. Land benefited by any shall be assessed for the costs thereof. Benefi include: drainage improvements; navigation disposal; flood protection; erosion cont creased wildlife; and benefits to cities. (H Fla)
W69-08787

WATERSHEDS AND DRAINAGE SYSTEM
Minn Stat Ann, secs 112.65 to 112.85 (1964

Descriptors: *Minnesota, *Watersheds (B *Drainage systems, *Watershed manag Contracts, Water conservation, Drains, D Dams, Dikes, Legislation, Legal aspects, Ad trative agencies, Flood control, Land tenure governments, State governments, Federal g ment, Projects, Bridges, Banks, Constr Riparian rights, Operation and maintenance

The managers of a watershed district, directed, shall take over, operate and maint judicial or county drainage system. Construc all new drainage systems or improvements to ing systems shall be initiated by filing a p with the managers. If it is necessary to dredge or other equipment through any bri grade the district managers shall give the thereof 20 days notice to move the struct allow passage. The district shall pay all c removal. The managers may enter contra cooperation and assistance with the federal g ment, state or local governments, corporat other improvement districts for the improv of the works of the district, make surveys and tain dams and dikes. Rights of landowners use of waters in the district shall continue as the establishment of the district but any im ments shall be the property of the district. A drainage laws remain in effect except where sistent with this chapter. An existing district enlarged or reduced by the proper proce (Helwig-Fla)
W69-08788

GENERAL PROVISIONS OF SUSQUEHANNA RIVER BASIN COMPAC TICLE 15.
Md Ann Code, art 96A:74 (Supp 1968).

Descriptors: *Maryland, *Interstate compac terstate commissions, *River basins, Goverr State governments, Water policy, Water re development, Interstate rivers, River basi missions, Water law, Rivers, Equitable app ment, Eminent domain, Condemnation, R rights, Legislation, New York, Pennsylvania of-way, Legal aspects.
Identifiers: Susquehanna River Basin Compa

This article itemizes the auxiliary powers Susquehanna River Basin Commission a functions of the commissioners in fulfilling jects and purposes of the Commission. Th mission may make and enforce rules and tions for the effectuation of the Susquehann Basin Compact. The Commission shall h power to acquire by condemnation the fee s interest in land, land under water, devel rights, riparian rights, water rights and o terests within the basin for projects author the compact. The Commission has the auth locate rights-of-way for aqueducts, lines conduits and other facilities required by th

n. Nothing contained in this compact shall or interfere with the law of the signatory s relating to riparian rights. (Helwig-Fla))8789

ION.

nn Code art 25, secs 161-166 (1957), as led, (Supp 1968).

iptors: *Maryland, *Erosion control, *Struc- *Construction costs, Erosion, Legislation, governments, Assessments, Taxes, Bodies of Public benefits, Condemnation, Annual Maintenance costs, Diversion structures, cing, Bonding, Benefits.

visions of land abutting upon any body of in the state constitute separate taxing and as- ent districts. The county commissioners, act- a district council, may upon application of 75 nt of the property owners in a district, con- erosion control structures. Land for con- ion or maintenance may be taken by ase or condemnation. The taxing power of istrict may be pledged to secure bonds for uction and purchase costs or the district may t up to 75 per cent of the costs from the state leral government, financing the remainder gh bond issues. When plans for the structure ompleted a hearing will be granted to land rs in the district, after which the commis- rs shall determine whether to proceed with ructure. Upon completion of any erosion con- tructure the lands shall be assessed for the thereof in proportion to the benefit received. ssessments shall constitute liens on the land to id annually as taxes. Additional assessments e levied annually to defray maintenance ex- s and interest costs on the bonds. (Kahle-Fla) 08790

.TH.

nn Code art 43, secs 2, 5, 36, 228B, (1965), ended, (Supp 1968).

iptors: *Maryland, *Water pollution control, er supply, *Public health, Administrative ies, Drainage, Diseases, Public benefits, State nments, Legislation, Regulation, Shellfish, ion abatement, Pollutants, Sewage disposal, age, Basins, Water quality control, investiga- Maps, Water pollution sources, Legal s.

fiers: *State boards of health.

tate Board of Health and Mental Hygiene, int to its duty to make sanitary investigations, nspect private property in regard to the ce of nuisances and diseases and make rules ting the character and location of plumbing, ge, water supply and sewage disposal. The or of the Board, whenever directed by the ior, shall make special investigations of institutions and shall advise the legislature vernor in regard to the location of drainage, supply, waste disposal, ventilation and heat- such institutions. The Board shall examine all and private water supply systems, prepare of the same, control basins of public water s, investigate and report upon all sources of on in water supply systems, and investigate port upon all private and public systems of disposal. The Board shall restrict the taking ing of shellfish in waters determined to be d. The water in the restricted area must be at least twice a month and restrictions lifted he waters again comply with standards for ting shellfish. (Kahle-Fla) 8791

TH.

n Code art 43 secs 387, 388, 389, 393, 397, 965), as amended, (Supp 1968).

Descriptors: *Maryland, *Public health, *Water quality control, *Water supply, Water pollution control, Industrial wastes, Pollutants, Permits, Potable water, Municipal water, Public benefits, Regulation, Legislation, Administrative agencies, Pollution abatement, Sewage disposal, Sewerage, Water pollution sources, Legal aspects.
Identifiers: *Sewerage systems.

The terms 'waters of the State', 'sewage', 'waterworks', and 'sewerage systems' are defined. The State Board of Health shall have general control over the waters of the State insofar as their condition affects public health and it may make regulations to correct and prevent pollution. All waterworks and sewerage systems shall be examined and their operation in a manner which will protect public health compelled. The Board may upon request consult with municipalities or private persons as to the most appropriate sources of water supply and the best methods of sewage disposal. It shall also advise industries whose manufacturing may tend to pollute state waters. When the Board finds any waters in danger of pollution because of defective water supply or sewerage systems, it may order the installation of a public system or the completion of the existing system. When waters are polluted by industry, the Board may order cessation of pollution or order alterations in disposal methods. Alteration plans must be submitted by the industry for approval and a permit issued for use of the revised method. The Board shall supervise the bottling of water for potable purposes, and no such water shall be bottled except under permit of the Board. (Kahle-Fla)
W69-08792

PROVISIONS RELATING TO FLOOD CONTROL COMPACT.

Vt Stat Ann tit 10, secs 841-848 (1958), as amended, (Supp 1968).

Descriptors: *Vermont, *Flood control, *Federal-state water rights conflicts, Legislation, Administrative agencies, Dams, Reservoirs, Flood damage, Multiple-purpose projects, Federal government, Political aspects, Cities, Damages, Water resources development, Connecticut, Massachusetts, Water rights, Public lands, Rivers, Taxes, Reimbursable costs, Local governments, Interstate compacts, Interstate rivers.
Identifiers: *Connecticut River Valley, Connecticut River, Economic loss.

The Connecticut River Valley Flood Control Commission shall consists of three members to be appointed by the governor for staggered terms of six years. Vacancies on the Commission shall be filled as provided for by general state law except that the governor may make interim appointments to fill vacancies that come into existence while the state senate is in adjournment. Provisions are made for expenses of the commissioners and appropriations for the Commission. When reimbursement for losses stemming from federal ownership of flood control dams or reservoirs are received from Massachusetts or Connecticut, the state treasurer must notify the state auditor. The board must keep accurate records of all reports issued by the auditor in this regard. The state shall reimburse its political subdivisions for ten per cent of the amount lost to them by reason of the federal ownership of such flood control dams and reservoirs and not reimbursed by Massachusetts or Connecticut. (Shevin-Fla)
W69-08793

DAMS AND DRAINS; GENERAL PROVISIONS.

SC Code Ann secs 18-401 thru 18-411 (1962).

Descriptors: *South Carolina, *Drainage districts, *Water conservation, *Water utilization, Legislation, Levees, Land tenure, Land, Canals, Drains, Ditches, Watercourses (Legal), Damages, Conservation, Costs, Construction, Flood protection, Flood control, Floodwater, Water storage, Erosion control, Waste water disposal, Administrative agencies, Legal aspects, Water storage, Financing.
Identifiers: Obstruction to drainage, Penalties (Criminal), Penalties (Civil).

If any drainage district organized under this chapter is in an area where another district is already established, the newer district shall be known as a subdrainage district. Whoever shall obstruct or damage any drainage works constructed under this chapter shall be guilty of a misdemeanor, subject to fine or imprisonment and be liable for double the cost of removing such obstruction or repairing such damage. Drainage districts may be used as agencies of the state for insuring watershed conservation. The board of supervisors of the district may authorize the development and execution of programs relating to any phase of water conservation, water usage, flood prevention, flood control, control of erosion, floodwater and sediment damages, and may make provisions for constructing such works as they believe necessary to insure conservation and storage of water within the district. Drainage districts may enter into agreements with and receive financial assistance from state agencies, federal agencies, or private landowners. (Shevin-Fla)
W69-08794

LAKE LEVELS INVESTIGATION AND PROCEEDINGS.

NH Rev Stat Ann secs 484:1 thru 485:1 (1968).

Descriptors: *New Hampshire, *Water levels, *Investigations, *Outlets, Legislation, Withdrawal, Administrative decisions, Administrative agencies, Riparian rights, Public benefits, Management, Public rights, Water level fluctuations, Inland waterways, Outlet works, Regulation.

The water resources board may make preliminary investigations of conditions affecting the use of any inland public water of the state. If such investigation indicates that the management and control of any outlet of such public water seriously or adversely affects shore property above or riparian rights below such outlet or the enjoyment of such water by the public, the board may make further investigations and ascertain the respective rights of all interested parties. Even though such management is deemed lawful the board may recommend changes therein that would benefit other interested parties and not injure the owner of the outlet. If the recommended changes would injure the owner or other interested parties the board may estimate damages occasioned thereby and report its findings to the governor. If the owner's actions are unlawful the attorney-general may institute proceedings against him. Unlawful use of an outlet subjects one to a maximum fine of $1000. Withdrawals from Lake Winnipesaukee are statutorily controlled; however, in emergency situations the board has the power to vary the defined withdrawals. (Holt-Fla)
W69-08795

DESIGNATION OF NAVIGABLE STREAMS AND PENALTIES FOR OBSTRUCTION THEREOF.
SC Code Ann secs 70-1 - 70-7 (1962), as amended, (Supp 1968).

Descriptors: *South Carolina, *Navigable rivers, *Obstruction to flow, *Rivers, Bodies of water, Legislation, Streams, Navigable waters, Navigation, Riparian rights, Streambeds, Water pollution, Barriers, Local governments, Public health, Legal aspects, Timber piles, Lumber, Lumbering.
Identifiers: *Obstruction of navigation, Penalties (Criminal).

All streams rendered capable of being navigated by rafts of timber or lumber and all navigable watercourses are declared navigable streams. They shall be common highways and forever free to all inhabitants of this state and all citizens of the United

States. Anyone obstructing such a stream shall be guilty of a nuisance. Anyone cutting trees or logs or throwing refuse into any navigable stream or anyone floating logs so as to obstruct any river shall be guilty of a misdemeanor. All timber or rafts floating so as to be dangerous to navigation shall be captured and sold at market. All riparian landowners shall keep clean all streams adjacent to their land. Certain enumerated counties shall be exempt from provisions of section 70-3 and 70-4 of this title pertaining to obstruction of navigable streams. The cutting or felling of trees into streams in certain enumerated counties so as to lessen the flow or endanger the community health shall be a misdemeanor. (Helwig-Fla)
W69-08796

WATER POLLUTION (POWERS OF COMMISSION IN RELATION TO POLLUTION).

Del Code Ann tit 7, secs 6301-6306 (Supp 1966).

Descriptors: *Delaware, *Pollution abatement, *Water pollution control, *Administrative agencies, State governments, Public health, Industrial wastes, Sewage, Regulation, On-site investigations, Legal aspects, Administration, Research and development, Recreation, Public rights, Investigations, Legislation, Administrative decisions.
Identifiers: *Summary proceedings, *Injuctions (Prohibitory), Public hearings, Water and Air Resources Commission.

It is part of the public policy of this state to prevent new pollution of the state's water and to control existing pollution. The Water and Air Resources Commission has jurisdiction to regulate water pollution by enforcing the laws relating to water pollution. The commission shall study and investigate all problems of pollution and recommend solutions. Also the commission shall adopt regulations for the installation of systems to control pollution. The commission may issue orders directing private persons or other political entities to control pollution. To insure compliance with its orders the commission may make investigations and inspections. The commission may at reasonable times inspect any industrial or municipal establishment for conditions relating to pollution. Also the commission may require information from any person pertinent to the commission's duties. When the commission's orders are not complied with, the commission may seek an injunction to prevent further violations. The commission may institute immediate action to protect public health by issuing a written directive ordering the cessation of pollutant discharges. As soon as possible thereafter, a hearing must be given to persons directed to so cease. (Gadd-Fla)
W69-08797

TAX DITCHES.

Del Code Ann tit 7, secs 4185-4193 (1953), as amended, (Supp 1966).

Descriptors: *Delaware, *Administrative agencies, *Drainage districts, *Land management, Drainage, Legislation, Regulation, Jurisdiction, Ditches, Taxes, Government finance, Water law, Legal aspects, Land, Permits, Maintenance, Drainage programs, Maintenance costs, Financing, Operation and maintenance.
Identifiers: *Tax ditches.

Ditch managers are responsible for removal of obstructions and repair of ditches caused by persons either willfully or negligently when, after a warning, such persons refuse to correct a situation caused by them which damages a drainage system. Such person is liable for all loss or injury caused by his actions. Upon petition to and approval by the superior court a ditch order may be amended so as to allow a landowner to be included in a tax ditch formed under provisions of this chapter. When land drains into a tax ditch when said land's owner is not a member of same, such landowner is responsible for the cost necessary to adding his lands to the ditch order and is subsequently liable for taxes on same. A tax ditch may be changed as deemed necessary by majority vote of the taxables present at regularly called tax ditch meetings. A tax ditch may be dissolved in a similar manner. Bridges and culverts under public roads as well as ditches near highways are maintained at the expense of the state. (Johnson-Fla)
W69-08798

OBSTRUCTIONS AND DAMAGE TO ROADS.

SC Code Ann secs 33-491, 33-493, 33-496 thru 33-500 (1962).

Descriptors: *South Carolina, *Drainage, *Highways, Surface drainage, Ditches, Drainage effects, Culverts, Railroads, Industrial water, Bridges, Dams, Canals, Channels, Lakes, Reservoirs, Flooding, Obstruction to flow, Roads, Flow augmentation, Legislation.
Identifiers: *Obstruction to drainage, Highway damage, Penalties (Criminal).

No person shall obstruct ditches and drainage openings along any highway. Nor shall any railroad company obstruct the drainage of any public road, or empty water from its ditches into any public road, so as to cause injury to such road. Special provisions are made for the establishment of proper and sufficient drainage of highways in Newberry, Pickens and Saluda County. Violations of these sections subject the violator to a fine and/or imprisonment. (Shevin-Fla)
W69-08799

FISH, GAME: MISCELLANEOUS PROVISIONS.

SC Code Ann secs 28-3, 28-8, 28-8.1 (1962).

Descriptors: *South Carolina, *Fishing, *Recreation, *Land tenure, Fish, Streams, Navigable waters, Lakes, Legislation, Legal aspects, Regulation, Sport fishing, Hunting, Game birds, Trapping, Banks, Permits, Wildlife management.

All wild game, birds and fish, except fish inhabiting strictly private waters, are the property of the state. Any person entering upon another's lands for the purpose of hunting, fishing or trapping, without the consent of the owner, shall be guilty of a misdemeanor. No one shall fish or hunt from the banks of a navigable stream without the landowner's permission and consent. Such consent should be in writing if the owner might not be within 1 mile of the place where the person may be caught in the act of so fishing or hunting. (Carruthers-Fla)
W69-08800

FISH, GAME: ACQUISITION OF RIGHTS-OF-WAY.
SC Code Ann sec 28-141 (1962).

Descriptors: *South Carolina, *Right-of-way, *Land use, Public rights, Public benefits, Administrative agencies, Rivers, Tributaries, Streams, Leases, Legislation, Legal aspects, Land, Land tenure, Fish, Fishing, Sport fishing, Recreation, Compensation, Access routes.
Identifiers: Catawba River, Public access.

To insure reasonable public access to the Catawba River and its tributaries, the Division of Game may contract with landowners contiguous to said waters for public rights of ingress and egress over their lands to such waters. Such rights-of-way shall be leased for such terms as may be agreed upon between the Division and the landowners. If compensation need be paid, it shall come from the game fund of York County. (Carruthers-Fla)
W69-08801

LICENSES; RESTRICTIONS ON FISHING.

SC Code Ann secs 28-551, 28-551.1, 28-57 572, 28-575 thru 28-602 (1962), as ame (Supp 1968).

Descriptors: *South Carolina, *Regulation, ing, *Fish, Fly fishing, Ponds, Non-sport fish, fish, Trapping, Seines, Fish hatcheries, stocking, Fishing gear, Legal aspects, Fish ma ment, Control, Seasonal, Legislation, Permits. Identifiers: Night fishing, Limits, Licenses.

These regulations pertain to the regu management, and control of fishing. They est how and where game fish may be caught, methods of fishing are prohibited and other r tions concerning night fishing, trout season daily creel limits on game fish in general. R tions applicable to pond owners and the against trespass on ponds used to breed f oysters are also included. (Moulder-Fla)
W69-08802

SPECIAL PROVISIONS FOR GAME ZON 7.

SC Code Ann secs 28-661 thru 28-669 (196 amended, (Supp 1968).

Descriptors: *South Carolina, *Fishing, *F gear, *Fish conservation, Fish management, populations, Fish types, Herrings, Shrimp, Str Baits, Bait fishing, Gill nets, Catfishes, Legisl Legal aspects, Water policy, Reasonable use dlife conservation, Sport fishing, Nets, Fly f Water sports, Regulation, Seasonal, Control. Identifiers: Licenses, Penalties (Criminal).

It shall be unlawful for any person to use or p fish nets, seines, trotlines or set hooks or to sh gig fish at any time of year in any of the wat Game Zone No 7. This section does not ap shad, herring or shrimp fishing. This article not apply to persons fishing for sport with t propriate equipment. A set hook is a baited and line attached to a set pole along the ba shall be unlawful to sell or possess fish nets withstanding the above section, during c months, gill nets of a certain size may be u Game Zone No 7. It shall be permissible to inch nets for taking herring from the Great Pe River during open season. It shall be unlaw use any light or gig to take fish in this Game Game wardens shall confiscate and destroy legal fishing devices. This article shall not ap persons fishing for catfish with a license to u traps. Violators of provisions of this article sh guilty of a misdemeanor. Any person having possession, going to or coming from any w fish in excess of the legal limit shall be presun have killed or caught such fish. (Carruthers-F
W69-08803

DUTIES AND POWERS OF THE S DEVELOPMENT BOARD.

SC Code Ann sec 9-310 (1962).

Descriptors: *South Carolina, *Administ agencies, *Administration, *State governm Legislation, Water law, Water policy, aspects, Regulation, Organizations, Water Riparian rights, Eminent domain, Water control, Erosion control, Condemnation, Con tion, Operation and maintenance, Ditches, Reservoirs, Bridges, Bridge construction.

With the abolition and consolidation of number of boards and commissions within th government, including the South Carolina Coastal Waterway Commission and the N Resources Commission, the State Develo Board takes on a number of widely ranging and powers. The Board may build, maintai operate lakes, fills, dams, reservoirs, d drains, culverts, and bridges. Prevention an

of soil erosion and flood control are responsi-
ies of the board. It may acquire by purchase,
or condemnation any lands, waters, water
ts, riparian rights or flowage rights useful in
ying out its powers. (Johnson-Fla)
9-08804

CTRICITY.
Code Ann sec 24-12 (1962).

criptors: *South Carolina, *Electric power
duction, *Easements, *Right-of-way, Legisla-
, Condemnation, Transmission lines, Electric
erplants, Substations (Electrical), Dams, Im-
nded waters, Electric power, Legal aspects,
l property, Public utilities, State governments,
al areas.
tifiers: Rural electric cooperative.

ctric companies, state authorities, and rural
tric cooperatives are granted the right to
uire rights-of-way, easements, and property for
structing and operating power lines and for
structing electric plants and impounding water.
procedure for obtaining rights-of-way is the
e as under sections 58-301 through 58-313 of
code which pertain to telegraph and telephone
panies. Easements and property may be ob-
ed under the procedure set up for condemna-
under section 58-302. No public lands used for
generation or the transmission of electricity
be condemned. (Gadd-Fla)
9-08805

TER POLLUTION CONTROL AUTHORITY-
LES AND REGULATIONS.

C Code Ann 471-478 (1962).

criptors: *South Carolina, *Administrative
ncies, *Water pollution control, *Standards,
mits, Administration, Adjudication procedure,
e governments, Regulation, Inspection, Water
ution, Water treatment, Waste water treat-
t, Water pollution treatment, Sewage treat-
t, Treatment facilities, Pollutants, Water quali-
ontrol, Legislation, Civil engineering, Classifi-
on.
tifiers: Waters classification, Administrative
rings.

erally, standards applicable to waters which
ive sewage, industrial wastes or other wastes
to be such that these discharges do not impair
best usage of the waters. Compliance with stan-
ls is shown by tests or analytical determinations
wing standard procedures set up by the
hority. Standards of quality and purity are
blished for the following classes: (AA) for
estic use and food processing with sterilization
required; (A) for swimming water; (B) for
estic use after complete treatment; (Ca) for
survival, industrial uses, and other uses; and
for waters receiving wastes with no known
tment. Provisions are made for application to
Board of Health for any new disposal systems,
ations in existing systems, and increased
harges. Procedures for hearings are outlined,
iring a report of findings by an examiner in all
s. Before discharging any sewage or wastes into
waters, increasing discharge, or altering treat-
t processes, the party involved must make ap-
tion to the Authority and file a report
ared by a qualified engineer describing steps
n to prevent pollution. No construction may
mence on such projects without permit from
Authority. (Douberley-Fla)
-08806

CES.

nn Stat ch 54, sec 26 (Smith-Hurd 1967).

riptors: *Illinois, *Construction, *Safety,
ety factors, Wells, Cisterns, Cesspools, Quar-
Recharge, Basins, Excavation, Sumps, Legisla-
Legal aspects, Public benefits, Public health.
Identifiers: *Fences, Protective fencing, Penalties.

Any person or business owning, maintaining, using or abandoning any open well, cesspool, cistern, quarry, recharging basin, catch basin, sump or other excavation without covering or surrounding same with protective fencing is guilty of a misdemeanor. Upon conviction such person shall be fined or imprisoned or both. These provisions are not applicable while such structures are guarded by a watchman or while a workman is present performing services thereon. (Carruthers-Fla)
W69-08807

GENERAL PROVISIONS; PORTS AND MARITIME MATTERS.

SC Code Ann secs 54-101 thru 54-146 (1962).

Descriptors: *South Carolina, *Navigable waters, *Administrative agencies, *Port authorities, Cities, Riparian rights, Docks, Harbors, Right-of-way, Construction, Regulation, Damages, Legislation, Bays, Rivers, Streams, Dredging, Channel improvement, Ships, Facilities, Damages, Public utilities, Jurisdiction.
Identifiers: Obstruction to navigation, Negligence, Elections, Penalties (Civil).

Any city having a population of over fifty thousand persons and located upon a navigable stream, may purchase or otherwise acquire any lands, riparian rights, rights-of-way, or other property for the construction of a port facility. A port utilities commission shall be established for the city. Provisions for the election and terms of the commissioners and the methods of filling vacancies are set forth. The commission may adopt a seal and sue and be sued in the courts of the state. They may also charge reasonable rates for use of such facilities. Any damages caused to persons as a result of negligence in connection with the port facilities, may be recovered in an action against either the city or the commission. The commission may not incur indebtedness without the express authority of the city council. The State Ports Authority shall have jurisdiction over the bay of Charleston and shall provide for safe use of the same by vessels entering the harbor. (Shevin-Fla)
W69-08808

GASSAWAY V TRAVELERS INS CO (DAMAGE FROM UNDISCLOSED STORM SEWER).

439 SW 2d 605-610 (Tenn 1969).

Descriptors: *Tennessee, *Storm drains, *Drainage, *Subsurface runoff, Drains, Conduits, Drainage systems, Intakes, Pipes, Land tenure, Surface runoff, Judicial decisions, Legal aspects, Damages, Insurance, Risks, Construction, Foundations, Accidents, Remedies.
Identifiers: Open-throat inlet, Negligence.

Plaintiffs owned a residence beneath which defendant's insured had constructed an underground storm sewer. Plaintiffs and their grantors had no knowledge of the drainage facilities. Defendant had contracted to insure the builder of the residence against liability for accidental injury to the property. Water discharging from the drainage facilities caused the foundation of plaintiffs' house to settle. Plaintiffs obtained a judgment against the builder and sought in the court of chancery to collect on the judgment from defendant insurer. From a finding for plaintiffs, defendant appealed. The supreme court reversed, holding that in order for plaintiffs to collect the damage must result from an accident. The builder sold the lot with the knowledge of the existing drainage facilities along with the risks involved and had reason to believe that subsequent purchasers would not discover such conditions. The damages resulted from the negligence of the builder in not disclosing the adverse condition and potential damages which he could have reasonably foreseen. The damages did not result from an accident but from the builders negligence, and were not covered by the terms of the policy. (Helwig-Fla)
W69-08809

LAKE CHARLES HARBOR AND TERMINAL DIST V HENNING (EMINENT DOMAIN PROCEEDINGS IN PORT IMPROVEMENT).

409 F 2d 932-937 (5th Cir 1969).

Descriptors: *Louisiana, *Eminent domain, *Administrative agencies, *Harbors, Land tenure, Planning, Compensation, Judicial decisions, Legal aspects, Condemnation, Condemnation value, Local governments, Land appraisal, Port authorities, Storage tanks, Public benefits, Public rights, Jurisdiction, Adjudication procedure.
Identifiers: Harbor districts.

A harbor district brought expropriation proceedings for land as bulk storage facilities in a plan to improve the port. The nonresident landowners removed to the federal district court. The court held the land was expropriated for a public purpose and the court of appeals affirmed. The district's action did not violate the due process requirements of the fourteenth amendment since the district planned to construct bulk handling facilities of port commodities as an integral part of a port improvement plan. Although there was only one prospective user, the use was still public since any potential user had the same opportunity for use. There need not be actual immediate necessity for expropriation as long as there was a demonstrated future need and intended construction of the facilities within a reasonable time. The court refused to interfere with the district's discretion concerning the extent of property taken. The court also upheld the method of valuation by averaging four expert appraisals and the awarding of expert witness fees to the landowners as costs or as part of just compensation. (Breeze-Fla)
W69-08810

STATE HIGHWAY COMM'N V RISS (CONDEMNATION VALUE OF LAKE PROPERTY).

432 SW 2d 193-200 (Mo 1968).

Descriptors: *Missouri, *Condemnation, *Condemnation value, *Property values, Eminent domain, Right-of-way, Highways, Road construction, Lakes, Land development, Land use, Administrative agencies, Administrative decisions, Judicial decisions, Legal aspects, Water law, Landfills, Water rights, Flooding, Damages.

Defendant landowner was awarded $66,000 for part of a 680 acre tract condemned and taken by the state for highway purposes. Exceptions were taken regarding the condemnation value of the property taken and a jury awarded defendant $125,000. Defendant appealed from this latter award contending that the presence of a man-made lake, one end of which the proposed highway was to cross, enhanced the value of the property for development purposes to $1,342,500. Defendant's witness testified that this value figure was reached by a capitalized method of valuation and also that presence of the highway would destroy the value of the property for development purposes. The court agreed that the best use of defendant's property may have been prevented by the condemnation but that unless defendant was in such a position to have carried out such development at the data of the taking, value for development purposes could not enter into the damage computation. The court held, therefore, that the fact that the lake enhanced the value of the porperty for development purposes did not justify use of a capitalized method of valuation and affirmed the jury award of $125,000. (Carruthers-Fla)
W69-08811

KENTON COUNTY WATER DIST V ROGERS (JURY DAMAGES AWARD IN CONDEMNATION PROCEEDINGS).
433 SW 2d 891-893 (Ky 1968).

Descriptors: *Kentucky, *Condemnation value, *Easements, *Water storage, Storage tanks, Condemnation, Right-of-way, Conduits, Judicial decisions, Land tenure, Eminent domain.
Identifiers: *Highest and best use, Subdivision property, Enhancement value.

In a condemnation proceeding, condemnor obtained 1.72 acres of land on a 30 acre farm for the construction of a water-storage tank. Condemnor also obtained easements for a roadway and a sixteen inch water main. The jury awarded condemnees $9,000 after expert witnesses established the highest and best use of the land as subdivision property. On appeal by condemnor, the Court of Appeals of Kentucky held that although some of condemnee's witnesses lacked knowledge of subdivision property values, and others failed to allow enhancement value from the new roadway, the jury did not award excessive damages to condemnees. The court of appeals affirmed the jury award. (Harris-Fla)
W69-08812

FISH AND GAME.

NH Rev Stat Ann secs 206:10, 206:16 (1964).

Descriptors: *New Hampshire, *Wildlife conservation, *Fish conservation, *Regulation, Conservation, Fishing, Hunting, Seasonal, Legislation, Administrative agencies, Resource development, Crayfish, Fish management, Fishing gear, Bodies of water, Birds, Wildlife, Wildlife management, Legal aspects.

It is the duty of the director of fish and game to protect, propagate and preserve fish, game, bird and wildlife resources of the state. He has the power to make and enforce rules and regulations for such purposes, including the authority to open and close the season for taking fish, setting number, weight and size limits for fish, and the manner of taking of fish. Such authority may be exercised over the state as a whole or over any county, part thereof, or body of water. Such authority shall not extend to regulation of seasons for taking game, birds or other wildlife, or the limits of the same. The director has power to close any body of water to the taking of crayfish for any length of time necessary in order to protect the crayfish population of such body of water. (Kahle-Fla)
W69-08813

ATLANTIC MARINE FISHERIES.
NH Rev Stat Ann secs 213:1-213:6 (1964), as amended, (Supp 1967).

Descriptors: *New Hampshire, *Interstate compacts, *Marine fisheries, *Atlantic Ocean, Shellfish, Anadromous fish, Marine fish, Commercial fishing, Sport fishing, Regulation, Legislation, Administrative agencies, Fish conservation, Fisheries, Fishing, Fish management, Interstate commissions.

The provisions of the Atlantic States Marine Fisheries Compact are set out. The purpose of the compact is to promote better use of Atlantic seaboard fisheries through development of a joint program. The compact shall become effective whenever two of the listed Atlantic states have executed it. Each signatory state is to appoint three representatives to an interstate commission which shall ascertain methods to conserve marine, shell anadromous fisheries. The commission shall draft and recommend legislation to the various states, advise administrative agencies as to problems of fisheries and recommend stocking programs. The federal fish and wildlife service of the department of the interior shall act as a research agency for the commission. An advisory committee of commercial fishermen and salt-water anglers shall be set up to advise the commission. Each member state agrees to contribute to the support of the commission in proportion to the value of its fisheries' products. Each state initially agrees to contribute an amount based upon the catch record of 1938. Subsequent budgets will be recommended by a majority of the commission. An amendment to the compact allows joint regulatory agencies among consenting states with respect to common fisheries. The governor of New Hampshire is authorized to execute the compact on behalf of New Hampshire. The New Hampshire commission members are the fish and game director, a legislator who is a member of the commission on interstate cooperation, and a private citizen appointed by the governor. (Kahle-Fla)
W69-08814

BRIDGES.
Vt Stat Ann tit 19, secs 1601-1604, 1621-1625, 1711-1718 (1968).

Descriptors: *Vermont, *Bridges, *Operation and maintenance, *Management, Administrative agencies, Costs, Cost transfer, Cost repayment, Bridge construction, Bridge design, Maintenance, Maintenance costs, Operating costs, Legislation, Legal aspects, Administration, Local governments, Cities, Eminent domain, Roads, Highways, Appropriation, Financing, Culverts, Transportation, State governments, Political aspects.
Identifiers: *Covered bridges, *Toll bridges, Penalties (Civil), Drawbridges.

Operation, maintenance and all powers incidental thereto vested in the Missisquoi Bay Bridge Commission are transferred to the state highway board. The board shall: (1) operate and maintain the Missisquoi Bay bridge; (2) assume outstanding liabilities created by the Commission; (3) pay outstanding notes of said Commission; and (4) accept and receipt for cash turned over to the board by said Commission. The board shall maintain, toll free, the sandbar bridge and the highway extending southerly therefrom. The selectmen shall cause covered bridges, located where a highway approaches such bridge from an angle, to contain openings on the side facing the highway. The use of covered bridges may be restricted to vehicles in regard to weight, height, and width. Voting procedures respecting the establishment of such restrictions and penalties for violations of such restrictions are provided. Public notice shall be given of the intent to destroy or remove a covered bridge. Drawbridges conveyed to the state shall be operated and maintained by the state. State highway board members shall also be toll bridge commissioners, and shall have the power of eminent domain, the authority to make agreements regarding the freeing of toll bridges, the authority to reimburse towns for their freeing of toll bridges and shall have general supervision over such freed toll bridges as are in Vermont. Any person crossing toll bridges without paying the toll shall be fined. (Carruthers-Fla)
W69-08815

DISPOSAL OF WASTEWATER FROM WATER FILTRATION PLANTS.

Am Watrwks Ass'n J Vol 61, No 7, p 322-326, July 1969. 5 p, 2 ref.

Descriptors: *Water purification, *Waste water disposal, *Waste water treatment, *Water pollution sources, Coagulation, Flocculation, Filtration, Sludge treatment, Freezing, Financial feasibility, Chemical reactions, Density, Beds, Sedimentation, Sediment discharge, Suspension, Turbidity, Chemical analysis, Water chemistry, Filtering systems, Quality control, Settling basins.
Identifiers: Water filtration plants, Precoat vacuum filter, Alum recovery

Recent changes in standards of many states have classified the waste flows from water filtration plants as potential pollutants. Although such waste flow consists only of the same solids that wo normally be found in the stream, they are poter pollutants because their increased concentra may inhibit biological activity in beds where t settle and because they would be readily disce bie and easily stirred up by turbulence in receiving water. Four possible methods for trea such pollutants are briefly discussed. There are: disposal to the sewerage system for treatment; filtration on a precoat vacuum filter; (3) freezin change the character of the gelatinous hydroxid granular form; and (4) alum recovery by regen tion with sulfuric acid. The advantages and di backs, including the financial feasibility of e method is discussed. The freezing process is gested as most advantageous where land are available for sludge volume produced and wh suitable winter temperatures occur. Alum recov is cited as most advantageous for large filtra plants where round-the-clock operation could maintained. (Kahle-Fla)
W69-08816

PURE WATER DEVELOPMENT ACT.

111 Ann Stat ch 19, secs 1021-1 thru 102 1022-1 thru 1022-5, 1023-1 thru 1023-7 (Sm Hurd Supp 1969).

Descriptors: *Illinois, *Administrative agenc *Recreation facilities, Sewage treatment, W pollution, Water pollution treatment, Land Recreation, Government finance, Local gove ments, Municipal wastes, Industrial wastes, Lo Grants, State governments, Federal governm Water conservation, Water resources devel ment, Treatment facilities.

The Pure Waters Board is authorized to assist financing of programs for the conservation development of natural resources from fu derived under the Pure Waters Development B Act. The Board may finance the acquisition state agencies of land to be used for recreatio facilities provided such financing is necessary will be matched by local funds. The project m have been approved by the appropriate plann commission and conform to the statewide outd recreation plan. No property so acquired may converted to other use without permission of Board. The Board may also make grants or loan municipalities, sanitary districts or intermunici and interstate agencies for construction of sew treatment facilities. Grants must be necessary completion of the project and may not exceed 3 of the estimated cost thereof. Such projects m comply with federal regulations, be effective reducing pollution to an acceptable level, be compliance with current regulations of the Bo and be approved by the appropriate planning co mission. The Board is authorized to establish a l guarantee program to assist private industry in purchase of pollution control devices. (Kahle-Fl W69-08817

KASKASKIA RIVER WATERSHED.
Ill Ann Stat ch 19, sec 41.1 (Smith-Hurd S 1969).

Descriptors: *Illinois, *Administrative agenc *Watersheds (Basins), *Water resources devel ment, Land use, Regulation, Legislation, C tracts, Navigation, Flood control, Drainage, W supply, Levees, Rivers, Dams, Water utilizati Watershed management.
Identifiers: Kaskaskia River, Carlyle Dam.

The Department of Public Works and Buildi may independently contract with any federal ag cy, political subdivision of the state, private pa or corporation in connection with navigation, fl control, drainage, levee, water supply and w storage, to be used in the development of Kaskaskia River watershed including restrictio use or withdrawal of water from the river be Carlyle Dam. The Department shall have juris tion and supervision over all phases of the devel

it of such basin and control over all lands uired in connection therewith. The Department grant, lease, sell, exchange, or otherwise use land in any manner not inconsistent with the poses for which it was acquired. (Kahle-Fla)
9-08818

MOVAL OF OBSTRUCTIONS.

Ann Stat ch 19, secs 47a-47e (Smith-Hurd 3).

criptors: *Illinois, *Boats, *Boating regulation, lvage value, Ships, Navigation, Navigable ers, Damages, Lumber, Legislation, Adminis- ive agencies, State jurisdiction, Remedies, ams, Bodies of water, Buoys, Obstruction to , Administrative decisions, Barriers, Marking nniques.
ntifiers: *Obstruction to navigation, *Sunken sels, Penalties (Fines), Wrecks.

unlawful to obstruct navigation by anchoring sels, voluntarily or carelessly sinking vessels, or ting timber in navigable waters of the state. hen craft must be marked by their owners with ys and lighted lanterns until removed. Failure promptly remove such craft shall be considered abandonment. When such abandonment has ex- d for more than 30 days, notice may be given to owner. After an additional 30 days the vessel y be removed and disposed of by the Depart- nt of Public Works and Buildings. After such ice, the Department may advertise for bids for removal of the wreck. Money received from the e of the wreck or from the contractor removing wreck shall be paid to the state. If such amount nsufficient to reimburse the state for expenses, owner of such wreck shall be liable for the dif- ence. Vessels sinking, grounding, or unneces- ily delayed in navigable waters may be im- diately removed or destroyed by the Depart- nt in order to clear the waters. Removal costs ll be a charge against such vessels. If not paid hin 30 days, such costs may be recovered by ing the vessel or cargo at public auction with the ner remaining liable for expenses not reim- sed. Violations of these provisions are demeanors punishable by fine and/or imprison- nt. (Kahle-Fla)
9-08819

AUKEGAN PORT DISTRICT.

Ann Stat ch 19, secs 180, 182.1-182.4, 192 nith-Hurd 1963).

scriptors: *Illinois, *Administration, *Navigable ers, *Regulation, Legislation, State govern- nts, Administrative agencies, Navigation, Har- s, Permits, Boating regulations, Docks, Coastal ctures, Jetties, Bulkheads, Bulkhead line, akwaters, Bridges, Engineering structures, irs, Deposition (Sediments), Abatement, Rock avation, Rock fills, Excavation, Dredging, res, Seashores, Bridge construction, Piers, ts, Anchors, Construction, Landfills, Legal ects.
ntifiers: Navigational obstructions, Penalties iminal).

igable waters are defined as any public waters ble for commerce. The Waukegan Port District mpowered to issue permits for construction of structures within forty feet of any navigable ers and for removal or deposit of any material in igable waters. Plans, profiles and specifications the fill or construction must be submitted to the t District before issuance of permits. A max- m penalty of $5,000 or one year imprisonment nposed for failure to secure a permit, and any vity may be abated or modified at the discretion he Port District. The District is also empowered prevent or remove obstructions in navigable ers, locate and establish dock lines and shore or oor lines, regulate water vessels, and regulate operation of bridges. (Douberley-Fla)
9-08820

JOLIET REGIONAL PORT DISTRICT.

Ill Ann Stat ch 19, secs 252.14, 254.1-254.4 (Smith-Hurd Supp 1969).

Descriptors: *Illinois, *Legislation, *Administration, *Navigable waters, State governments, Administrative agencies, Navigation, Harbors, Permits, Regulation, Boating regulations, Docks, Coastal structures, Jetties, Bulkheads, Bulkhead line, Breakwaters, Bridges, Engineering structures, Weirs, Depositions (Sediments), Abatement, Rock fills, Shores, Seashores, Bridge construction, Piers, Boats, Anchors, Construction, Landfills, Legal aspects.
Identifiers: Nagivational obstructions.

Navigable waters are defined as public waters usable for commerce. The Joliet Regional Port District is empowered to issue permits for construction of all structures within fifty feet of any navigable waters and for deposit of any material in navigable waters. The District may also prevent or remove obstructions in navigable waters, locate and establish dock lines and shore or harbor lines, regulate water vessels, and regulate operation of bridges. (Douberley-Fla)
W69-08821

SHAWNEETOWN REGIONAL PORT DISTRICT.

Ill Ann Stat ch 19, secs 402.14, 404, 404.1, 414 (Smith-Hurd 1963), as amended, (Supp 1969).

Descriptors: *Illinois, *Administration, *Navigable waters, *Regulation, Legislation, State governments, Administrative agencies, Navigation, Harbors, Permits, Boating regulations, Docks, Coastal structures, Jetties, Bulkheads, Bulkhead line, Breakwaters, Bridges, Engineering structures, Weirs, Deposition (Sediments), Abatement, Rock excavation, Rock fills, Excavation, Dredging, Shores, Seashores, Bridge construction, Piers, Boats, Anchors, Construction, Levees, Cities, Landfills, Legal aspects.
Identifiers: Navigational obstructions, Penalties (Criminal).

Navigable waters are defined as public waters usable for commerce. The Shawneetown Regional Port District is empowered to issue permits for: (1) construction of all structures within forty feet of any navigable waters, except for bridges which cross waterways used as state boundaries and are operated by the city; and (2) deposit of any fill materials in navigable waters. Plans, profiles and specifications for the fill or construction must be submitted to the Port District before issuance of permits. A maximum penalty of $5,000 or one year imprisonment is imposed for failure to secure a permit, and any activity may be abated or modified at the discretion of the Port District. The Port District may also: prevent or remove obstructions in navigable waters; locate and establish dock lines and shore or harbor lines; regulate water vessels; regulate operation of bridges, with the exceptions noted above; and build, repair and maintain levees. (Douberley-Fla)
W69-08822

SOUTHWEST REGIONAL PORT DISTRICT.

Ill Ann Stat ch 19, secs 452.14, 454, 467 (Smith-Hurd 1963).

Descriptors: *Illinois, *Administration, *Navigable waters, *Regulation, Legislation, State governments, Administrative agencies, Navigation, Harbors, Permits, Boating regulations, Bulkhead line, Breakwaters, Bridges, Engineering structures, Weirs, Deposition (Sediments), Abatement, Rock excavation, Rock fills, Excavation, Dredging, Shores, Seashores, Bridge construction, Piers, Boats, Anchors, Construction landfills, Legal aspects.
Identifiers: Navigational obstructions, Penalties (Criminal).

Navigable waters are defined as public waters usable for commerce. The Southwest Regional Port District is empowered to issue permits for: (1) construction of all structures within forty feet of any navigable waters, except for bridges which cross a waterway used as a state boundary and are operated by any city; and (2) deposit of any fill materials in navigable waters. Plans, profiles and specifications for the fill or construction must be submitted to the Port District before issuance of permits. A maximum penalty of $5,000 or one year imprisonment is imposed for failure to secure a permit, and any activity may be abated or modified at the discretion of the Port District. The District may also: prevent or remove obstructions in navigable waters; locate and establish dock lines and shore or harbor lines; regulate water vessels; and regulate operation of bridges, with the exceptions noted above. (Douberley-Fla)
W69-08823

NATURAL RESOURCES DEVELOPMENT BOARD.

Ill Ann Stat ch 19, secs 1071 thru 1077. 13 (Smith-Hurd Supp 1969).

Descriptors: *Illinois, *Administrative agencies, *Water resources development, *Water conservation, Water resources, Water quality, Watersheds (Basins), Navigation, Rivers, Legislation, Regulation, Government finance, State governments, Federal government, Project planning, Water supply, Flood control, Project purposes.

The Natural Resources Development Board is created in order to insure proper planning for the conservation and development of water resources. The members of the board shall be the directors of certain related state agencies and shall serve without compensation. The Board shall prepare a biennial assessment of the quality and quantity of available water resources and recommend legislation to insure adequate future supplies. In addition the Board shall: disseminate information to citizens regarding water supply programs; advise the governor on proposed federal and state legislation; implement policies to insure coordination of state agencies; examine state projects, identify areas where new projects are needed, and report to the governor thereon; represent the state in federal projects involving more than one state agency in matters of navigation, flood control, rivers, and watersheds; administer local programs for water resources and development as provided by law; establish and supervise regional water resources management commissions; cooperate with public and private agencies and receive funds from such agencies or the federal government; and administer all programs authorized by the legislature pursuant to the Natural Resources Bond Act. (Kahle-Fla)
W69-08824

DRAINAGE AND FLOOD CONTROL.

Ill Ann Stat ch 42, secs 472, 473, 481, 482 (Smith-Hurd Supp 1969).

Descriptors: *Illinois, *Flood control, *Administrative agencies, *Drainage, Legislation, Legal aspects, Water law, Water policy, Financing, Sewage disposal, Water utilization, Projects, Administration, Public health, Sewers, Drainage systems, Hydrographs, Drainage districts, Flood protection, Charts, Distribution patterns, Floods, Hydrograph analysis, Rainfall, Runoff, Mapping, Assessments.

The Department of Public Works and Buildings is responsible for making a survey and preparation of a master plan for drainage and flood control of all watershed areas of this state so that hazards to persons and property may be reduced. Such plan includes the full hydrography of each watershed area including rainfall, runoff, frequency and severity of floods. A drainage district may, when it finds that its drainage system is collecting sewage which is a menace to public health, construct a sewage disposal system to eliminate such sewage. Such a

system may be financed through assessments on the lands benefitted. Revenue bonds may be used to pay the initial costs of such construction, to be repaid solely from the revenue from the operation of such system. The Department is responsible for general coordination and supervision of the efforts of the individual districts. It may also enter agreements with the federal and local governments for the formulation of plans, including funding, and for the construction, operation and maintenance of improvements for flood control, drainage and utilization of water and water resources. (Johnson-Fla)
W69-08825

SANITARY DISTRICTS OUTSIDE OF MUNICIPALITIES.
Ill Ann Stat ch 42, secs 418, 421, 433, 437, 438, 439 (Smith-Hurd 1956), as amended, (Supp 1969).

Descriptors: *Illinois, *Administrative agencies, *Environmental sanitation, *Sewage disposal, Water purification, Sanitary engineering, Water law, Legislation, Legal aspects, Water policy, Administration, Financing, Taxation, Dams, Public health, Sewage treatment, Planning, Sewers, Sewage, Water utilization, Water pollution, Water pollution control, Water quality control.
Identifiers: *Sanitary districts, Special assessments.

The board of trustees of any sanitary district is responsible for the collection and disposal of sewage within their area and must protect the water supplied to their inhabitants from contamination. They may use such conduits, pipes and pumps as are necessary to construct an adequate sewage system for this purpose. They must also treat and purify all sewage before allowing same to flow into any lake, river or other water course. While real and personal property may be taken for the district's corporate purposes, whether by purchase or condemnation, adequate compensation must be paid therefore either by gross sum or annual rental. The district's sewers may pass along or under public roads or public ground and may have conduits and pipes laid under public waters, but in either case not in such a manner as to impede normal use thereof. A district has the power to keep its water courses free from pollution and may construct dams and remove debris from same in the interests of public health. The board may finance costs of such a system either through general taxation or special assessment. (Johnson-Fla)
W69-08826

REND LAKE DAM AND RESERVOIR.

Ill Ann Stat ch 42, secs 410.11, 410.12 (Smith-Hurd Supp 1969).

Descriptors: *Illinois, *Financing, *Federal government, *Costs, Dams, Contracts, Legislation, Water law, Legal aspects, Administrative agencies, Administration, Repayment contracts, Benefits, Economics, Projects, Public benefits, Compensation, Cost allocation, Cost sharing, Water policy, United States, Dam construction, Operation and maintenance.

The Governor and the Rend Lake Conservancy District may give assurance to any agency of the United States Government for the performance of items of non-federal participation involved in the construction, operation, and maintenance of the Rend Lake Dam and Reservoir on the Big Muddy River. The Department of Public Works and Buildings enters into such contracts with agencies of the federal government as are necessary for the purpose of reimbursing the United States in accordance with the Federal Water Supply Act of 1958 for the construction costs and the annual operation and maintenance costs allocated to certain water-supply storage improvements provided, however, that costs shall be limited to the increased cost of the project which the United States Government incurs in providing features of construction, operation and maintenance that result in benefit to the people of Illinois. (Johnson-Fla)
W69-08827

SANITARY DISTRICTS.
Ill Ann Stat ch 42, secs 312, 317 (Smith-Hurd 1956), as amended (Supp 1969); secs 317a (Supp 1969).

Descriptors: *Illinois, *Sewage, *Administrative agencies, *Environmental sanitation, Legislation, Legal aspects, Water law, Dams, Financing, Public Health, Sanitary engineering, Sewage disposal, Sewage treatment, Wastes, Water purification, Regulation, Planning, Beds, Ownership of beds, Beds under water, Sewers, Cost allocation, Water utilization, Taxes, Water quality control.
Identifiers: Special assessments, Sanitary districts.

A sanitary district may construct and maintain its sewers, channels, ditches and drains along, across or under any highway, street or public ground of the state so long as public use of such property is not hampered. Districts may construct and maintain such conduits and pipes upon any of the lands of the state which are under public waters provided permission from the governor is obtained before so doing. The board of trustees of each district is responsible for the construction of necessary facilities within the district including drains, sewers, laterals and pumping stations which are financed by either general taxation or by a combination of general taxation and special assessments. When a district has constructed a sewage disposal plant, the board of trustees may build a dam or dams to regulate the flow of the waters of any stream or river if the public health would be improved thereby. The board may also take such action as is necessary to remove debris, refuse and other objectionable matter from any river within the district after the construction of a sewage disposal plant. (Johnson-Fla)
W69-08828

FISH RESTORATION AND MANAGEMENT PROJECTS.

Ill Ann Stat ch 56, secs 249-250 (Smith-Hurd 1967).

Descriptors: *Illinois, *Fish management, *Federal government, Fish establishment, Fish populations, Projects, Fish conservation, Administrative agencies, Administration, Fishing, Fisheries, Permits, Costs, Cost transfer, Legislation, Legal aspects, State governments, Federal project policy, Regulation.
Identifiers: *Fish restoration projects, Licenses.

Illinois hereby assents to the provisions of the federal statute entitled 'An act to provide that the United States shall aid the states in the fish restoration and management projects, and for other purposes.' The Illinois Department of Conservation is hereby authorized to perform acts necessary to the conduct and establishment of such projects in compliance with said act and rules and regulations promulgated by the Secretary of the Interior thereunder. Fishing license fees shall not be diverted for any other purpose than the administration of the Department of Conservation. (Carruthers-Fla)
W69-08829

FISH.

Ill Ann Stat ch 56, secs 243-247 (Smith-Hurd 1967), as amended, (Supp 1969).

Descriptors: *Illinois, *Fish harvest, *Fish management, *Minnows, Fish, Frogs, Turtles, Mussels, Shellfish, Transportation, Fishing gear, Bait, Commerical fish, Commercial fishing, Permits, Storage, Storage capacity, Storage tanks, Fishing, Sport fishing, Recreation, Legislation, Legal aspects, Judicial decisions, Regulation, Control, Administrative agencies.
Identifiers: Fish preserves, Restricted fishing areas, Licenses.

The Illinois Department of Agriculture has disc
tionary power and authority to set aside waters
the state as fish preserves in which it is unlawful
take fish, minnows, frogs, turtles or mussels exc
as hereinafter provided. The Department also
such discretionary authority to designate cert
waters as restricted fishing areas in which it is
lawful to take fish with commercial devices dur
certain designated time periods. It is unlawful
any person to destroy or deface any notice
proclamation posted pursuant to this act. It is
lawful to receive for shipment fish or other mar
life protected by this act unless there is presente
wholesale fish dealer's license. Detailed shipp
restrictions are set forth. Specific regulati
govern commercial minnow dealers and wholes
minnow dealers regarding shipment of minno
various containers of minnows, license appli
tions, and storage ponds for minnows. Speci
regulations also govern retail minnow dealers. M
nows held in storage ponds can be sold at any ti
of the year but may not be transported beyond
state's borders. Any judicial decision holding a p
of this act unconstitutional or invalid shall not
fect validity of the remainder of the act. (C
ruthers-Fla)
W69-08830

**POWERS OF THE DEPARTMENT OF CONSE
VATION.**

Ill Ann Stat ch 127, secs 63a5, 63a15, 63a
(Smith-Hurd 1967).

Descriptors: *Illinois, *Pollution abateme
*Water conservation, *Administrative agenci
Legislation, Water pollution control, State gove
ments, Fishing, Recreation facilities, Parks, Boa
Rivers, Lakes, Streams, Regulation, Boating re
lations, Legal aspects.

The Department of Conservation shall have the
lowing powers: (1) to exercise all rights, powe
and duties conferred by law and to take such m
sures as are necessary for the prevention of po
tion in rivers, lakes, streams, and other state wate
(2) to designate the size, type, and kind of bo
that may be used on lakes owned and operated
the Department; and (3) the power to provide ro
boats and other watercraft for daily rental a
reasonable fee at any of the state parks, public fi
ing areas or other properties of the Departm
where such boating facilities are considered fea
ble. (Heckerling-Fla)
W69-08831

**POWERS OF THE DEPARTMENT OF CONSE
VATION.**
Ill Ann Stat ch 127, sec 63a 1 (Smith-Hurd 1967

Descriptors: *Illinois, *Wildlife conservati
*Wildlife management, *Administrative agenci
Legislation, Frogs, Fish, Turtles, Wildlife, Cons
vation, Shellfish, State governments, Distributi
Preservation, Legal aspects.

The Department of Conservation shall have
power to take all measures necessary for the c
servation, preservation, distribution, introducti
propogation, and restoration of fish, mussels, fro
turtles, game, and other wild animals. (Heckerli
Fla)
W69-08832

**SUSQUEHANNA RIVER BASIN COMPAC
WATER SUPPLY AND WATER QUALI
MANAGEMENT AND CONTROL.**
MD Ann Code art 96A: 63, 64 (Supp 1968).

Descriptors: *Maryland, *Interstate commissio
*Water supply, *Water quality control, Interst
compacts, River basins, Legislation, New Yo
Pennsylvania, State governments, Water resour
control, River basin commissions, Water mana
ment, Dams, Reservoirs, Storage, Surface wa
Ground water, Water quality, Reservoir stor
Water pollution control, Water policy, Dome

ter, Industrial water, Dam construction, Regula-
n.
ntifiers: *Susquehanna River Basin Compact.

e Susquehanna River Basin Commission shall
ve the power to effectuate projects for the use of
in water for domestic, municipal, agriculture
l industrial water supply. It may construct,
uire and operate dams, reservoirs and other
uctures to this end. The commission may provide
the storage and release of waters for the regula-
n of water flow to protect public health, stream
ality control, pollution control, recreation,
vention of undue salinity and other purposes.
signatory parties shall cooperate in the storage
l release operations. The commission may pro-
e water management and regulation in the main
eam or any tributary in the basin and may apply
eneficial assessment therefore to all water users.
e commission shall not engage in the business of
tributing water. The commission may undertake
dies for water quality management and control
l may acquire, construct and operate facilities
the management of water quality in the basin. It
ll be the policy of the commission to encourage
elimination of water pollution and the establish-
nt and enforcement of water quality standards.
elwig-Fla)
69-08845

**FECT OF PUBLICITY ON VALUATION IN
NDEMNATION OF THE PROPOSED IM-
OVEMENT,**
izona State Highway Dept., Phoenix.
nley Z. Goodfarb.
ght Way, p 16-19, Apr 1969. 4 p.

scriptors: *Condemnation, *Condemnation
lue, *Property values, *Real property, *Land ap-
aisal, Effects, Legal aspects, Negotiations,
minent domain, *Judicial decisions, Jurisdic-
n, Projects, Land, *Right-of-way.
ntifiers: *Valuation, *Publicity, Land acquisi-
ns, Effect.

e public announcement of a construction project
en precedes construction by several years. The
veloper who moves in early to be adjacent to the
provement will often acquire his property before
public agency has acquired the land required to
ild the proposed improvement. As a result, often
public agency must purchase or condemn part
the land that the developer bought. The problem
sing is that land values increase after the an-
uncement of the planned improvement. The
veloper paid a higher price because of the
posed improvement, but the public agency
en will offer him less than he paid for the proper-
Courts usually rule that the value of a property
not be enhanced legally by reason of its prox-
ty to the very project for which the property is
ng acquired. The rule also works in reverse so
t properties cannot be depressed in value by the
nouncement of an unpopular or unattractive
icture, such as a proposed sewer plant in an
ablished neighborhood. The value of the proper-
acquired must be measured at its value before
announcement of the proposed improvement.
SBR)
69-08846

**MPREHENSIVE WATER POLLUTION CON-
OL PROGRAM.**
primary bibliographic entry see Field 05G.
69-08863

AINAGE DISTRICTS (1-7).

Va Code Ann, sec 19-21-1 thru 19-21-41
66), as amended, (Supp 1968).

scriptors: *West Virginia, *Drainage districts,
risdiction, *Financing, Legislation, Water law,
al aspects, Taxes, Eminent domain, Assess-
nts, Administration, Construction, Cost-benefit
o, Appraisals, Publications, Reviews, Adminis-
trative agencies, Costs, Bridge construction, Planning, Ditches, Operation and maintenance.

Drainage districts are to be organized under circuit court jurisdiction. Objections and appeals to the formation of districts are provided for. The act makes provisions for: owners' meetings; the election of a board of supervisors and the appointment of a chief engineer; and the funding of preliminary expenses. A board of appraisers is to be established for assessing the benefits to those property owners within the district. A jury assessment is to be available. The procedure for letting contracts is enumerated. The act provides for the annual levying of taxes and the method of collection. It indicates when the taxes are payable and outlines the procedure for collection of delinquent taxes. All bonds are considered liens on the district lands. The power to drain, protect and reclaim land is given to the board. The district shall have the power to eminent domain. Costs of bridge construction are to be borne by the district. Actions are not abated by the death of the parties. Procedures for formulating new plans, removing officers, connecting, maintaining, and preserving ditches and consolidating adjacent districts are outlined. A penalty is prescribed for obstructing drains. (Holt-Fla)
W69-08878

DRAINAGE DISTRICTS (1).
W Va Code Ann, sec 19-21-1 thru 19-21-5 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Drainage districts, *Jurisdiction, *Land reclamation, Public benefits, Public health, Legislation, Water law, Engineers estimates, Engineering personnel, Reclamation, Wetlands, Construction, Administrative agencies, Legal aspects, Cities, Flood control.

The circuit courts are conferred with the power to establish, organize and provide for the operation and maintenance of drainage, levee and reclamation districts. When organized the districts have the power to reclaim lands and construct such levees, ditches and canals as are necessary to carry out the purposes of the act. These purposes are to improve wetlands and to protect cities from overflow. All district projects must result in public benefits, promote the public health or be conducive to the general welfare of the community. Three or more owners of real property within a proposed district may petition the court to establish a drainage district. The petition must generally describe the lands to be reclaimed and the advantages that will result from the proposed improvement. After the petition is filed the court shall appoint a qualified engineer who must recommend the general improvements required, make an estimate of their costs and file a list of all property holders within the proposed district. Following the engineer's report the circuit clerk must publish a notice to the property owners that the petition has been filed. Procedures are outlined by which any landowner within the proposed district may object to its formation. (Holt-Fla)
W69-08879

DRAINAGE DISTRICTS (2).
W Va Code Ann, sec 19-21-6 thru 19-21-11 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Drainage districts, *Drainage programs, *Administration, Administrative costs, Legislation, Organizations, Water law, Land reclamation, Reclamation, Taxes, Tax rate, Financing, Supervisory control (Power), Surveys, Engineers estimates, Drainage engineering, Project planning, Costs.

Within 30 days after any drainage district is established the circuit clerk shall call a first meeting of the landowners for the purpose of electing a board of supervisors. Subsequent to the first meeting the board shall call annual meetings of the landowners to re-elect supervisors. The board of supervisors is required to annually report to the landowners any work that has been done in the district. A competent civil and drainage engineer shall be appointed by the supervisors within 30 days after organization of the district. His duties shall be to survey all lands within the district that may be improved or reclaimed and to submit a proposed plan for draining, leveeing, and reclaiming the lands described in the survey. If the board approves the plan it shall be designated as 'the plan for reclamation.' A tax of up to 50 cents per acre on all lands within the district shall be levied by the board to defray preliminary expenses. (Holt-Fla)
W69-08880

DRAINAGE DISTRICTS (3).
W Va Code Ann, sec 19-21-12 thru 19-21-16 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Reclamation, *Assessments, *Appraisals, Legislation, Water law, Administration, Drainage districts, Judicial decisions, Railroads, Right-of-way, Maintenance costs, Benefits, Damages, Condemnation, Administrative decisions, Compensation, Property values.

Upon acceptance of a plan for reclamation by the board of supervisors and the filing of it with the circuit court, 3 uninterested appraisers are to be appointed by the judge whose duties shall include the assessment of benefits and damages that may result from implementation of the plan. The chief engineer shall accompany and advise the appraisers. When assessing benefits on each parcel of land within the district due credit is to be given for any existing systems of reclamation. Railroads and rights-of-way shall be assessed according to the increased physical efficiency and decreased maintenance costs. Lands outside the district's boundaries that will be benefitted are to be assessed and reported to the court for possible inclusion within the district. Notice by publication of the appraisers' report is to be given. Interested parties may file exception to the appraisers' report with the court and a summary hearing shall be provided. Anyone aggrieved by an assessment may present his complaint to the circuit court. The court's findings may be appealed. Property owners not accepting the assessment by the appraisers are entitled to a jury assessment consistent with the proceedings for condemnation of rights-of-way by railroad, telegraph and telephone companies. (Holt-Fla)
W69-08881

DRAINAGE DISTRICTS (4).
W Va Ann, sec 19-21-17 thru 19-21-22 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Drainage districts, *Taxes, *Assessments, Reclamation, Legislation, Administrative decisions, Administration, Construction, Cost-benefit ratio, Contracts, Bids, Benefits, Adjudication procedure, Legal aspects, Financing.

The board of supervisors shall have the power to build and complete all works necessary to carry out the plan for reclamation. The board may let contracts for such works to the lowest bidder who shall give bond for the contract price. The board shall levy a tax on all lands assessed benefits sufficient to pay the cost of completion as shown in the plan for reclamation plus 10 per cent of such cost for emergencies. Such taxes shall constitute a preferred lien on the real property in the district. An annual installment of the total taxes shall be levied thereafter by the board. (Holt-Fla)
W69-08882

DRAINAGE DISTRICTS (5).
W Va Code Ann, sec 19-21-23 thru 19-21-28 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Drainage districts, *Administration, *Taxes, Legislation, Regulation, Assessments, Reclamation, Condemnation, Drains, Alteration of flow, Watercourses (Legal), Natural

streams, Construction, Appropriation, Financing, Budgeting, Compensation, Operation and maintenance.

All bonds issued by the board of supervisors of any drainage district constitute a lien on all lands assessed therein and the board must levy an annual tax as needed to retire the bonds. In order to effect the drainage, protection, and reclamation of the land within the district the board is empowered: (1) to alter drains and watercourses within and without the district; (2) to construct and maintain all necessary works within and without the district; (3) to remove any obstacles within or without the district; and (4) to hold, control and acquire any lands or property interests within or without the district. The right to condemn any land not acquired by the court upon the appraiser's report is given to the board. The board may employ an attorney to act for and advise them. The board may not enter or appropriate any land for works of the district until the price is paid the owner or in the hands of the circuit clerk. (Holt-Fla)
W69-08883

DRAINAGE DISTRICTS (6).
W Va Code Ann, secs 19-21-29 thru 19-21-34 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Drainage districts, *Construction costs, *Ditches, Railroads, Public utilities, Natural streams, Watercourses (Legal), Specification, Construction structures, Boundaries (Property), Boundary disputes, Reclamation, Legislation, Cost allocation, Administrative agencies, Legal aspects.

The cost of constructing any public ditch or drain across any public highway or the right-of-way of any railroad, tramway or other public utility shall be borne by the drainage district. If the ditch follows a natural watercourse and it becomes necessary to enlarge any structure upon said watercourse then such enlargement shall conform to the district's chief engineer's specifications and the expense shall be borne by the county, railroad, tramway or other public utility so involved. The cost of all necessary constructions where said construction does not follow a natural watercourse shall be borne by the district. The cost removing and replacing any structure to enable the passing of any dredge boat or other equipment shall be borne by the district. Specific procedures for the amendment of the plan of reclamation are set forth. Provisions are also included to enable any owner to object to such proposed amendments. (Holt-Fla)
W69-08884

DRAINAGE DISTRICTS (7).
W Va Code Ann secs 19-21-35 thru 19-21-41 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Drainage districts, *Administration, *Financing, Taxes, Drainage, Reclamation, Assessments, Obstruction to flow, Administrative decisions, Ditches, Watercourses (Legal), Legislation, Maintenance costs, Acreage, Legal aspects, Administrative agencies, Costs, Cost repayment.
Identifiers: Penalties (Criminal).

The board of supervisors of any drainage district may issue serial bonds not to exceed 90% of the unpaid taxes levied. Funds from the bonds shall be used to pay the cost of the drainage works and improvements. If the plan for reclamation is deemed inadequate the board may formulate new or amended plans and additional assessments may be made. All ditches and watercourses in existence prior to the inception of the plan for reclamation may be made a part of the works and improvements of the plan at the board's discretion. The circuit court, however, may review the board's discretion. A maintenance tax may be levied annually by the board upon completion of the improvements. Two or more adjacent districts may be united if a majority of the acreage voters approve a petition to unite. It shall be a misdemeanor to obstruct a drain or damage drainage works. (Holt-Fla)
W69-08885

A UNIFIED CABINET-LEVEL DEPARTMENT OF WATER DEVELOPMENT AND OPERATION HAVING FULLY COORDINATED FUNCTIONAL SERVICES TO MEET MODERN NEED,
Shu-t'ien Li.
For 8-Volume Proceedings See Vol 2, No 9, 06B W69-03305. Proc International Conference on Water for Peace, Vol 5, p 365-369, 1967.

Descriptors: *Water resources development, *Planning, *Administrative agencies, *Coordination, Social needs, Governments, Administration, Water policy, Inter-agency cooperation, Adoption of practices, Federal government, Management, Control, Water conservation.

The author proposes that a cabinet-level department of water development and operation be established to fully coordinate the functional services required to meet modern water needs. It is suggested that as a nation becomes more civilized, the more illogical and unstreamlined its governmental agencies for water development and operation become. The major services a cabinet-level department would provide would be: (1) national hydro-data; (2) national hydro-conservation; (3) national water supply; (4) national waste-water sanitation; (5) national reclamation and flood control; (6) national hydroelectric power; (7) waterways, harbors, and maritime administration; (8) water pollution control; (9) interstate water; (10) international cooperation; (11) water development financing; (12) water research and development; and (13) wet space. Under each of these services would be several bureaus handling segments of the services. (Heckerling-Fla)
W69-08886

EXECUTIVE LEADERSHIP AND COMMUNITY INNOVATION: THE FLUORIDATION EXPERIENCE,
State Univ. of New York, Buffalo; and Chicago Univ., Ill.
Donald B. Rosenthal, and Robert L. Crain.
Urban Affairs Quarterly Vol 1 (3), March 1966, 39-57.

Descriptors: *Decision-making, *Fluoridation.
Identifiers: City-Managers, Mayors, Public support.

Utilizing an approach to governmental decision-making which is different from most studies, the authors study the same issue in every case and report the relationship between the public position taken by the Mayor and the outcome of the decision in 362 cities. The author contends that the position taken by the Mayor is crucial in understanding the decision a community makes with respect to fluoridation. In turn, the Mayor is influenced by certain pressures operating in the community, but he is more than a mere pawn in the decision-making process. Mailed questionnaires were sent to local informants, the publisher of the largest local newspaper, the local health officer, and the city clerk in each of 1,186 cities. The central finding is that the position taken on fluoridation by the formal executive leadership (the Mayor or City-Manager) virtually determines the decisions made by the government; if the Mayor does not publicly support fluoridation, there is very little chance for its adoption. The data point out the importance of the Mayor as an important positive cue for voters and as a symbolic leader of the community. One of the factors which seems to play a major part in the City-Manager's stand is the extent of his professionalism, which may create attitudes more favorable toward innovation. The non-professional managers are equally (if not more) willing to support fluoridation when it is not controversial. The professional manager, however, is the main support of the 'cause' when it is controversial. This is consonant with the image of the manager as a man in touch with new developments effecting municip government, and one more likely to have conti ing contact with and respect for technical expe (Fortinsky-Chicago)
W69-08891

DEVELOPMENTS IN THE UNITED NATIO RELATING TO SEA-BED AND OCEAN FLOO
G. Haight.
Nat Resources Lawyer, Vol 11, No 2, p 119-1 May 1969, 12 p. 42 ref.

Descriptors: *United Nations, *International co missions, *International waters, Foreign countri Water resources development, International la Oceans, Continental shelf, Pollution, Beds, Be under water, Mineralogy, Boundaries (Propert Resources, Legal aspects, Resource development

The 23rd session of the General Assembly of t United Nations adopted four resolutions relating resources of the ocean floor beyond the limits present national jurisdiction. The first establishe 42 nation committee, including the United Stat to study the elaboration of principles to promo international cooperation in the use of the resources and to ensure that their exploitation w be for the benefit of all mankind. There is gene agreement that precise boundaries need to be s beyond which no nation may lay claim by use, o cupation, or otherwise, but there is much disagre ment between developed and developing countri over the use of the resources. The developing cou tries are in favor of a 'common heritage' doctri which would ensure that the resources wou redound in considerable measure to their e richment, that economic injury to them would prevented, and that their interests would be a corded major consideration. The second resoluti which deals with the pollution of those resource passed without opposition. The third resoluti requesting the Secretary General to study t establishment of 'appropriate internation machinery' in regard to these resources was o posed by the developed countries as a step towa the 'common heritage' theory. The fourth resol tion relates to an international Decade of Oce exploration under the aegis of the United Nation (Kahle-Flrida)
W69-08980

POLITICAL BEHAVIOR AND THE DECISIO MAKING PROCESS IN THE ALLOCATION O WATER RESOURCES BETWEEN RECRE TIONAL AND MUNICIPAL USE,
Clark Univ., Worcester, Mass.
Roger E. Kasperson.
Natural Resources Journal, Vol 9, No 2, p 176-21 Apr 1969. 36 p, 5 fig, 11 tab.

Descriptors: *Decision making, *Water resource Political aspects, Management, Water supp Legislation, Planning, Water allocation.
Identifiers: *Political behavior, *Water disput Recreational use, Municipal use, Awarene Knowledge, Political behavior, Organization, Sp tial linkage.

Recent research has substantially extended our u derstanding of the ways by which private i dividuals manage a particular natural resource concern with the degree of knowledge and accu cy of perception by the resource manager and t significance of such cognition for the decisio making process is a prominent attribute of the studies. At the same time, however, these resear findings illustrate the key role which the politic system plays in such questions in a modern, ind trial state. The author contends that the speci issue of resource allocation and management a derivatives of more general problems of politic economy. Nevertheless, a corresponding thrust research into the interactions among individ resource users has not been forthcoming. By e amination of one local political conflict over bo the spatial and functional allocation of wa resources, this study seeks (1) to present some i

finding on characteristics of attitudes and ical behavior in a water resource dispute, and to identify a number of larger issues in the ne management of natural resources. (Loeb-ers)
-08982

E NEW MACHINERY TO HELP DO THE

onsin Univ., Madison, Wis.
b H. Beuscher.
nvironmental Quality in a Growing Economy, more, The Johns Hopkins Press, 1966. p 156-8 p, 1 ref. Henry Jarrett, Editor.

riptors: *Federal government, *Conservation, ter management, *Technology, Water pollu- Flood-plain, Streams, Pesticides, Watercour- Water quality, Wetlands, Coasts, Inland water-, Wildlife, Fisheries.
tifiers: *Residual sovereignty, *Regional rnment, *Environmental quality, State ning, Problem shed, Water disposal, Data, elands, Externalities.

article deals with the importance of compiling quantities of data about environmental quality ne place, and of keeping this information cur- In addition, this data should be continuously yzed, with a special interest toward discovering relationships. As far as the governmental par-ation in this process is concerned, joint boards d serve to carry out direct regulatory programs mproving environmental quality in interstate ns, until such time as interstate compacts d be made. State governments can serve as the cy to care for environmental problems in opolitan regions that are unable to be handled ny regional unit. The state could be given bar-ing status with private developers, in hopes of ding previous environmental problems. State experiments can also be broadened to include ral/state relations, as well as state/state and /local relations, with efficient improvement of ronmental quality as the goal. Courts still ld not be eliminated from their position in e problems, but not much should be expected them. This article is of interest to water archers, due to the use of water problems as ex-les in governmental actions. (Murphy-Rutgers)
-08984

ITICAL ENVIRONMENT OF WATER OURCES,

ell Univ., Ithaca, N.Y.
ard B. Dworsky.
he Fresh Water of New York State: Its Conser-n and Use, p 21-28, Wm C. Brown Book Co, ique, Iowa, 1967. 8 p, 1 disc. Lauren B. cock, Editor.

riptors: *Political aspects, *Water resources, r shortage, New York, Administration, Water rces development, Waste treatment, Water tion.
ifiers: *Political environment, STATE Water urces Commission, State water planning, Re- l water planning, Federal water planning, lative committees.

York State has made major strides in the past le in water management. Political leadership een sensitive to water problems. Change is ng new problems and the political environ-must be responsible to them. The author con- that legislative committee staffs must be thened and executive agencies need to be responsive to problem identification. State resources planning needs to keep pace with changes in regional and federal water rces planning and development efforts. The olicity of local government water units has d barriers to effective regional development nited water resources. These and other ems must be better managed if political fac-re not to impede future programs. The frame erence suggested to guide future policies in these and related questions are the basic purposes guilding the US Advisory Commission on Intergovernmental Relations in its efforts to strengthen the federal system. (Loeb-Rutgers)
W69-08988

TRANSACTION COSTS, RESOURCE ALLOCATION AND LIABILITY RULES--A COMMENT,
Yale Univ., New Haven, Conn.
Guido Calabresi.
Jour of Law and Ecom. Vol XI, p 67-73, April 1968. 8 p.

Descriptors: *Resource allocation, Joint costs, Welfare.
Identifiers: *Transaction costs, *Bargaining, Legal structures, Short run, Liability rules, Government intervention.

Professor Coase argued that (assuming no transaction costs) the same allocation of resources will come about regardless of which of two joint cost causers is initially charged with the cost, in other words regardless of liability rules. While the author believes this analysis is only correct for the short run, he does believe that it gives an admirable tool for suggesting what kind of empirical data would be useful in making resource allocation decisions and for indicating what kinds of guesses are likely to be justifiably made in the absence of convincing data. This analysis combined with common intuitions as to the relative costs of transactions, taxation, structural rules and liability rules can go far to explain various types of heretofore inadequately justified governmental actions. It can help us to delineate those areas of uncertainty where more facts would help us make better resource allocation judgments. This would also include judgments concerning the allocation of water resources. (Sokoloff-Rutgers)
W69-09000

FEDERAL AID FOR WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W69-09013

DELAWARE RIVER BASIN COMPACT.

Del Code Ann tit 7, sec 6501 (Supp 1966).

Descriptors: *Interstate commissions, *River basin development, *Interstate compacts, *Water utilization, Flood control, Flood plains, Hydroelectric power, Hydroelectric plants, Recreation, Water allocation (Policy), Water conservation, Water distribution (Applied), Water permits, Water resources development, Watershed management, Water shortage, Withdrawal, Pollution abatement, Interstate rivers, Project planning.
Identifiers: *Delaware River basin, INCODEL.

The Delaware River Basin Compact between Delaware, New Jersey, New York, Pennsylvania and the federal government sets up an interstate commission (INCODEL) to replace the numerous state and federal agencies previously exercising control over the basin. Each signatory party has one member on the commission, each with one vote. The commission has very broad powers to effectuate a comprehensive plan for development and use of basin resources on its own initiative, plus ultimate approval of all federal, state, municipal and private programs affecting these resources. All projects are to follow a comprehensive plan developed by the commission, supplemented by a more detailed water resources program. Specific areas of concern include development of water uses, pollution control, flood protection, watershed management, development of recreation and hydroelectric power, and regulation of withdrawals and diversions of water. Projects are financed by the parties according to benefits accrued from specific projects, by equitable apportionment among the parties, and by tax-exempt public bond programs. (Douberley-Fla)
W69-09015

ADMINISTRATION OF INTERNATIONAL RIVERS,
Wisconsin Univ., Madison.
I. K. Fox, Hans Gotzman, S. C. Smith, and T. U. Torti.
Paper presented at the United Nations Panel of Experts on Legal and Institutional Implications of Intern. Water Resources Development, December 9-14, 1968, Vienna, Austria, 47 p.

Descriptors: *Administrative agencies, Political aspects, Benefits, Treaties, Rivers, *River basins, Flexible foundations.
Identifiers: National interests.

This paper postulates a set of basic principles which should govern the administration of international river basin programs on the basis of a preliminary evaluation of experience in several different areas of the world. Five premises underlie the analysis: (a) National self-interest will have a powerful influence on the kind of administrative arrangements that are practicable; (b) Each nation will wish to weigh the consequences to it of alternative programs; (c) The full range of relations among the nations involved will influence the response of each nation; (d) The configuration of power and influence within a country will determine the kind of program that country will find acceptable; (e) The rapidity of technological change places a premium upon flexible arrangements. Seven principles emerge from the analysis: (a) Each participating nation must assess opportunities for realizing benefits through independent action; (b) Basic data for joint programs should be cooperatively developed; (c) The evaluation of benefits and costs of alternative joint plans must be undertaken by each nation individually; (d) Administrative arrangements should minimize opportunities for friction or disagreement in program implementation; (e) Administrative arrangements must assure faithful adherence to the agreed-upon program; (f) International treaties should emphasize basic principles rather than program details so as to facilitate changes when needed; (g) Initial agreements should make provision for joint consideration of possible changes as needed in the future. (Fox-Wis)
W69-09024

SOME POLITICAL ASPECTS OF LARGE SCALE INTER-BASIN TRANSFERS,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 06C.
W69-09025

6F. Nonstructural Alternatives

EVALUATION OF FLOOD PLAIN DELINEATIONS BASED ON SOIL MAPS IN THE TURTLE CREEK AND KICKAPOO RIVER WATERSHEDS, WISCONSIN,
Wisconsin Univ., Madison.
Robert M. Viaene.
Univ of Wisconsin Water Resources Center Report, 1969. 97 p. OWRR Project B-002-Wis.

Descriptors: *Flood plains, *Wisconsin, *Watersheds (Basins).
Identifiers: *Turtle Creek (Wis), *Kickapoo River (Wis), *Alluvial soils.

Results of these studies show that the boundaries of alluvial soils coincide most closely with the boundaries of rate floods, as determined by engineering methods, in older, dissected landscapes having well developed flood plains. In order to accurately delineate flood plains from soil maps in most areas, it is necessary to know which soils besides the alluvial soils are subject to flooding. An understanding of the geomorphic basis for the distribution of soils is essential. Stream gradient, land use patterns and the presence or lack of structures must be considered. The approach should be imaginative and interdisciplinary. An understanding of the limitations of different kinds of soil maps and their usefulness for flood plain mapping is also necessary so as to be able to choose the kind of additional infor-

mation that will be needed in particular areas. The use of other information to improve the reliability of soil interpretation does not reduce the value of soil maps for this purpose. Of the sources at hand in most places, soil maps depict the landscape from the broadest interdisciplinary approach. (Lee-Wis)
W69-09008

AN ACTIVITY ANALYSIS OF NON-STRUCTURAL FLOOD PLAIN MANAGEMENT ALTERNATIVES,
Wisconsin Univ., Madison.
John C. Day.
Univ of Wisconsin Water Resources Center Report, 1969. 121 p. OWRR Project B-002-Wis.

Descriptors: *Economic analysis, *Floods, *Nonstructural, Cost-benefit.

This report deals with the economic evaluation of non-structural measures for control of urban flood damages. The research objective was to explore the feasibility of certain quantitative techniques for the economic analysis of spatial land use of flood proofing. A simple linear programming model was developed for residential development in a presently vacant flood plain area. The analytical approach was tested using a small community in a 'demonstration study' framework. Data sources and limitations are discussed. The success of the approach in identifying an economically efficient land use planning response to flood problems is encouraging and indicates that further research is likely to be fruitful. (Author)
W69-09009

THE USE OF SOIL MAPS IN THE DELINEATION OF FLOOD PLAINS,
Wisconsin Univ., Madison.
John M. Cain, and Marvin T. Beatty.
Water Resources Research, Vol. 4, No. 1, February 1968, p 173-182, 9 p, 5 fig, 21 ref. OWRR Proj B-002 Wis.

Descriptors: *Wisconsin, *Mississippi River, Flood plains, River basins, Morphology.
Identifiers: *Soil maps, *Flood plain delineation, Southwestern Wisconsin, Morphology, Alluvial soils.

Soil maps provide a tool for rapid, low-cost delineation of river flood plains, based on the difference in morphology between soils frequently flooded and soils free of flooding. Very rare floods along the Mississippi River inundated over 99 percent of the soils that would be expected to flood but in addition flooded 7 percent of the terrace soils. Flooding predicted with soils information was compared with flooding predicted with an engineering study for small streams in a mature landscape in southwestern Wisconsin. For a 100-year synthetic flood an agreement of plus or minus 4.5 percent was obtained. Comparison of flooding with soil types for a small stream in a recently glaciated landscape in southeastern Wisconsin indicated that alluvial soils flo)d frequently and, in addition, that soils with restricted drainage and soils of fluvial origin also flood frequently. Some of the data are inconclusive, owing to the lack of precise flooding information to serve as a basis of comparison. In areas where man made works do not appreciably alter the stream regimen and where extensive flood plain areas must be delineated, it appears that accurate soil maps, properly interpreted, will give a good estimate of areas subject to flooding. (Cain-Wis)
W69-09017

07. RESOURCES DATA

7A. Network Design

STATISTICAL METHOD OF DETERMINING THE OPTIMUM NUMBER OF MEASUREMENTS OF STREAMFLOW CHARACTERISTICS,
State Hydrological Inst., Leningrad (USSR).
M. L. Ruppert.
Soviet Hydrol: Selec Pap, Issue No 2, p 115-123, 1968. 9 p, 1 fig, 3 tab, 9 ref. Trans Trudy Gos Gidrol Inst, No 150, p 17-28, 1968.

Descriptors: *Hydrologic data, *Statistical methods, *Surveys, *Sampling, Statistics, Estimating, Probability, Variability.
Identifiers: *USSR, Data requirements, Streamflow characteristics.

The theory of random variables is used to solve the problem of determining the amount of data necessary for hydrologic studies. Most hydrologic phenomena are the result of so many poorly understood natural factors that they may be regarded as random functions. Calculation of data requirements is based on determination of the probable error in the average value of a series as a function of the coefficient of variation and the number of measurements. (Knapp-USGS)
W69-08728

PROBLEMS OF NETWORK DISTRIBUTION AND EVALUATION OF THE METHODS BEST SUITED FOR HYDROMETRIC INVESTIGATIONS (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
I. F. Karasev, A. M. Gavrilov, P. A. Shestakova, K. S. Kabanova, and A. V. Savel'yeva.
Trudy Gos Gidrol Inst No 164, 1968. 164 p, 36 fig, 19 tab, 129 ref.

Descriptors: *Hydrometry, *Network design, *Mathematical studies, *Methodology, Irrigation districts, Drainage engineering, River basins, Statistical methods, Discharge (Water), Correlation analysis, Hydroelectric plants, Turbulent flow, Slopes, Winds, Velocity.
Identifiers: *USSR, Hydrometric methods evaluation.

A collection of 12 papers is presented that discuss distribution of hydrologic networks and the analysis of methods best suited for hydrological studies. Principles for the development of networks is discussed by N. F. Karasev. Distribution of hydrological networks in areas of large hydro-electric stations by A. M. Gavrilov, and principles of distribution of data stations by R. A. Shestakova are the basis of two papers. Networks in irrigated and drainage areas are discussed. Statistical basis for the density of hydrological networks in the Oka River basin is presented. M. L. Ruppert discusses the analysis of discharge curves using a correlation method. A variation-statistical study of the structure of turbulent flow in open channels is presented by I. F. Karasev. Other papers present information on measurement of water surface slopes where there are no flood plains, wind effects on coefficient of transition from surface to mean velocity, and laws governing velocity pulsations in conduits for hydro-power stations. (Gabriel-USGS)
W69-08734

URBAN WATER RESOURCES RESEARCH,
American Society of Civil Engineers, New York.
Urban Hydrology Research Council.
For primary bibliographic entry see Field 04C.
W69-08743

OBJECTIVE ASSESSMENT OF ADEQUATE NUMBERS OF RAINGAUGES FOR ESTIMATING AREAL RAINFALL DEPTHS,
British Meteorological Office, Bracknell (England).
For primary bibliographic entry see Field 02B.
W69-08928

THE EFFECTS OF DENSITY OF RECORI RAIN GAUGE NETWORKS ON THE DESC TION OF PRECIPITATION PATTERNS,
California Univ., Davis. Dept. of Water Sci and Engineering.
For primary bibliographic entry see Field 02A.
W69-08931

RAINFALL INPUT FOR HYDROLO MODELS,
Agricultural Research Service, Beltsville, Hydrograph Lab.
For primary bibliographic entry see Field 02A
W69-08932

7B. Data Acquisition

COMPUTER PROGRAM FOR CONVER NEUTRON PROBE READINGS TO S WATER EQUIVALENTS,
Forest Service (USDA), New Orleans, Southern Forest Experiment Station.
T. W. Popham, and S. J. Ursic.
Soil Sci 1969, 107 (4): 302.

Descriptors: *Computer programs, *Nu moisture meters, *Data processing, Instrum tion, Moisture meters, Nuclear meters, Soil sure meters, Moisture content, Soil moisture.

A program written in FORTRAN IV comp water equivalents by one of three methods Water equivalent= Depth increment (pe water by volume); (b) Water equivalent= Dep crement (A+ B (probe count)+ C (probe c 2)); (c) Water equivalent= Depth increment B probe count/shield count+ C (probe count/s count)2) where: A= Y intercept of calibr equation; B= linear coefficient of calibration e tion; and C= quadratic coefficient (when cal tion equation is linear the quadratic coefficie zero). (Author)
W69-08639

IMPROVED STANDARDS FOR NEUTRON S WATER METERS,
Forest Service (USDA), Oxford, Miss. Sout Forest Experiment Station.
S. J. Ursic
Soil Sci 1967, 104 (5): 323-325.

Descriptors: *Nuclear moisture meters, *Cal tions, *Instrumentation, Moisture meters, Nu meters, Soil moisture meters, Moisture con Soil moisture, Mississippi.

Economical standards made from polyeth cylinders 2.5 to 4.5 inches in diameter pr highly satisfactory for operational checks an calibrations of neutron soil water probe sys (Author)
W69-08640

USING RUNOFF EVENTS TO CALIBR SMALL FORESTED CATCHMENTS,
Forest Service (USDA), Oxford, Miss. Sou Forest Experiment Station.
S. J. Ursic, and T. W. Popham.
In 14th Congr Proc, Int Union Forest Res Org 319-324, 1967. (Munich, Germany).

Descriptors: *Calibrations, *Rainfall-runoff tionships, *Statistical methods, *Storm ru Water measurement, Mathematical mo Watershed management, Hydrologic aspects sissippi.
Identifiers: *Experimental watersheds, *Hyd ic analysis.

Calibration and analysis based on individual events appear efficient for evaluating chan the hydrologic performance of small catchments. The approach is particularly where effects of watershed treatment on chan ephemeral flow phenomena are of primary cern. (Author)

9-08641

LTIVARIATE METHODS USEFUL IN DROLOGY,
est Service (USDA), Berkeley, Calif. Pacific thwest Forest and Range Experiment Station.
mond M. Rice.
rnational Hydrology Symposium, Ft Collins, p -478, Sept 1967.

criptors: *Statistical models, *Correlation anal-. Demonstration watersheds, Soil erosion, Land ring, Brush control, Grasses, Drainage systems, s, Geology, Hydrograph analysis, Analytical niques, Mathematical studies.
ntifiers: *Multivariate statistics, Factor analysis, nonical correlation, Principal components, sh conversion.

ltivariate statistical methods exist which are logous to most of the univariate tests used in rology. In multivariate statistics, each in-dual can be described by multiple measure-nts thereby freeing the hydrologist from the d to describe a phenomenon by single number. ltivariate methods can estimate the probability roup membership based on such multiple mea-ements, test the equivalence of multidimen-al samples, assess the position of a multiple asurement observation with respect to two or re populations known to be different, estimate minimum number of underlying factors present larger set of correlated measurable variables measure the correlation between two sets of iables or predict one set from the other. Mul-riate techniques can be useful merely as ways of lyzing the dependence among sets of variates f the data are multivariate normally distributed, can statistically test hypotheses concerning itidimensional samples. They allow for a flexi-ty of approach which is more in harmony with nature of many hydrologic problems. Hydrolo-s should use these techniques when appropriate hey may benefit from the advantages of mul-riate statistical methods. (Author)
9-08661

NEW 'SPHINCTER' CORER WITH A COILLESS PISTON,
CLANT ASW Research Centre, La Spezia (Ita-

Kermabon, and U. Cortis.
rine Geol, Vol 7, No 2, p 147-159, Apr 1969. 13 fig, 3 ref, 2 append.

criptors: *Sampling, *Sediments, *Cores, uipment, Mechanical equipment, Design data, earch and development, Specification.
ntifiers: *Sphincter corers, Piston corer.

'Sphincter' corer developed by Kermabon et al intended as an improvement over most of the ting piston corers. It included the following two inal features: (a) A 'Sphincter-type' nylon core her, which seals the cores within a watertight ainer during retrieval; (b) A split piston, which ents suction of the core when the corer is eved from the sediments. However, this corer the defect inherent to all heavy piston corers after release the piston does not remain sta-ary. A simple system of monitoring the piston ively to a fixed platform lying on the sea floor scribed. The device involves only cables and pulleys and can be installed on any existing 'S-cter' corer. The equipment operates success-and little or no disturbance can be observed in ores. (Knapp-USGS)
-08696

D USE OF ORIFICE METERS,
ogical Survey, Huron, S. Dak.
primary bibliographic entry see Field 02F.
-08702

ESTIMATE OF THE RELIABILITY OF THE CHARACTERISTICS OF THE SHORTAGE IN SOLID PRECIPITATION DUE TO WIND,
Main Geophysical Observatory, Leningrad (USSR).
E. G. Bogdanova.
Soviet Hydrol: Selec Pap, Issue No 2, p 139-147, 1968. 9 p, 3 fig, 5 tab, 11 ref.

Descriptors: *Precipitation gages, *Snow, *Claibrations, Winds, Precipitation (Atmospheric), Snow surveys, Snowfall, Reliability.
Identifiers: *USSR, Snow gage corrections.

Sources of error in snow gaging are examined and a mathematical description of snow-catch by various gage types is given. Relationships are presented for calculating wind effect on snow gaging. Forests do not have sufficient aerodynamic effect on snowfall to require correction of snow survey data for clearings compared with the surrounding forest. Uncorrected gages in windy areas underestimate snowfall by as much as 100% or more. (Knapp-USGS)
W69-08725

THE CONSTRUCTION OF CALIBRATION CURVES FOR DETERMINING WATER CONTENT FROM RADIATION COUNTS,
East Malling Research Station, Maidstone (England).
For primary bibliographic entry see Field 02G.
W69-08756

THE APPLICATION OF GEOELECTRICAL METHODS TO GROUND-WATER EXPLORATION OF UNCONSOLIDATED METHODS TO GROUND-WATER EXPLORATION OF UNCONSOLIDATED FORMATIONS IN SEMI-ARID AREAS,
For primary bibliographic entry see Field 02F.
W69-08770

ACTIVATION ANALYSIS: A NEW TECHNIQUE FOR SOIL MOVEMENT STUDIES,
Iowa State Univ., Ames.
Craig E. Beer, and R. A. Hendrickson.
Agr Eng, Vol 50, No 3, p 144-145, Mar 1969. 2 p, 1 fig.

Descriptors: Soils, *Radioisotopes, *Tracers, *Sediment transport, *Isotopes, Movement, Gamma rays, Irradiation, *Sediment distribution, Laboratory tests, Hydrologic cycle, Hydrology.
Identifiers: *Activation analysis, *Lanthanum.

Laboratory test results show that lanthanum used as a tracer element in activation analysis permits detailed study of elements within a hydrologic cycle. In activation analysis, certain elements are irradiated with nuclear particles to produce radioisotopes. By counting the rate of disintegration of these radioisotopes, a quantitative evaluation of the amount of the original element present is possible. A soil-lanthanum test sample mixture was irradiated with thermal neutrons. Analysis showed that over 90% of the lanthanum adhered to the soil. The ultimate objective is to use lanthanum as a tracer element in activation analysis to study the origin and movement of sediments in certain phases of the hydrologic cycle. The procedure will involve mixing lanthanum in soil on a larger scale to produce a seeding batch. The treated soil will then be placed in the field at predetermined points. Sampling will be done immediately after seeding and at points along the flow path. The apparent ability of lanthanum to adhere to inert particles can make its use virtually unlimited. (USBR)
W69-08835

NUCLEAR LOGGING METHODS,
Mobil Research and Development Corp., Dallas, Tex.
Richard L. Caldwell.
Isotop Radiat Technol, Vol 6, No 3, p 257-273, 1969. 17 p, 15 fig, 2 tab, 18 ref.

Descriptors: *Logging (Recording), Borehole geophysics, Radioisotopes, Engineering geology, Gamma rays, Bibliographies, *Geophysics, Geologic investigations, Porosity, Oil-water interfaces, Nuclear meters, Rock properties, Radioactivity techniques, *Radioactive well logging, Rocks, Density, Minerals, Spectrum analysis, Photoactivation, Sediments.
Identifiers: *Gamma-gamma logging, Gamma probes, *Geophysical logging, *Well logging, *Nuclear density meters, *Nuclear probes.

New developments in nuclear logging methods are surveyed, placing emphasis on industrial uses. The discussion includes: (1) natural gamma logs for giving rock lithology, (2) gamma ray scattering for density and for locating concentrations of heavy elements in rocks, (3) neutron logs for porosity determination and oil-salt water differentiation, and (4) combinations of logs for identifying rocks and nonmetallic mineral deposits. Future nuclear logging methods are suggested for lunar and planetary surface analysis, ocean-bottom sediment-density gaging, and photo-nuclear activation of geologic samples. Computer methods are discussed for analyzing complex gamma spectra. (USBR)
W69-08841

AERIAL PHOTOGRAPHY,
Carl H. Strandberg.
Photogr Appl, Vol 2, No 8, 9, 10, p 25-30, 41-47, 23-43, Fall-Winter, Mar 1968-69. 21 p, 31 fig.

Descriptors: *Aerial photography, *Photogrammetry, Remote sensing, Photography, *Photographic equipment, Mapping, Measuring instruments, Water pollution, Photographs, Water pollution control, Optics, Optical instruments.
Identifiers: *Photointerpretation, Photomaps, Optimum crop yield, Resolution, Water pollution surveillance system.

Any photograph obtained from the air may be called an aerial photograph, but modern terminology frequently restricts this term to precise, high resolution photographs obtained from extreme altitudes. The first of this 3-part series is an introduction to aerial photography, including techniques and equipment. Some basic advantages of aerial photography are: location of the vantage point, resolution far superior to the unaided human eye, perception outside the visible spectrum, permanency, and geometric fidelity. The second part covers the state of the art of viewing equipment technology, projection interpretation, stereo projection, electronic viewing systems, application of filtering and multiband techniques in picture taking, and photogrammetric mapping. Two nonmilitary applications of photointerpretation and photogrammetry that may have a profound impact on our civilization are discussed. These applications are providing assistance in feeding the world's hungry millions and in the field of human health, particularly water pollution. (USBR)
W69-08859

TRACER DYNAMICS IN LAMINAR FLOW THROUGH POROUS MEDIA (ROMANIAN),
Academia R. P. R., Bucharest. Institutul de Fizica Atomica.
For primary bibliographic entry see Field 02F.
W69-08901

BIBLIOGRAPHY OF REMOTE SENSING OF EARTH RESOURCES FOR HYDROLOGICAL APPLICATIONS,
Geological Survey, Washington, D.C. Water Resources Div.
Rita K. Llaverias.
Geol Surv Open-file Rep, Sept 1968. 73 p, 4 ref. NASA-TM-X-61717.

Descriptors: *Bibliographies, *Documentation, *Remote sensing, *Hydrologic aspects, *Application methods, Earth (Planet), Aerial sensing, Cameras, Infrared radiation, Photography, Satellites (Artificial), Application equipment, Appraisals, Mapping, Methodology.

Identifiers: *Basic literature, *Earth resources, NASA.

This preliminary bibliography was prepared to acquaint hydrologists with the basic literature involved in this field. Some of the references concern specific hydrologic topics or specific remote sensing methods. Other references on vegetation mapping and geology were included so that the reader can find information on the selection, processing, and use of remote sensing data in these cognate fields. A number of meteorological references were included because in many remote sensing applications, especially from earth orbital satellites, atmospheric effects must be taken into account in interpreting the views of the earth. (Laverias-USGS)
W69-08902

LIQUID LEVEL DETECTION WITH SOLID STATE DEVICES,
Connecticut Univ., Storrs. Dept. of Agricultural Engineering; and Pennsylvania State Univ., University Park.
R. P. Prince, and G. W. Hawkins, Jr.
Proc Annu Meeting Amer Soc Agr Eng, June 22-25, 1969. Purdue Univ, Pap No 69-359, 1969. 6 p, 3 fig, 2 tab.

Descriptors: *Flowmeters, *Water levels, *Water measurement, *Instrumentation, Open channel flow, Closed conduit flow, Stage-discharge relations.
Identifiers: Water-level recorder.

A liquid level sensor using a series of water-shorted electrodes as a step-function generator is described. The design of a probe and associated solid-state electronic equipment is given. Flow histories and total flow volumes may easily be calculated by connecting the device to a chart recorder and calibrating the system for stage-discharge relations. (Knapp-USGS)
W69-08904

RADIOACTIVE TRACERS IN HYDROLOGICAL RESEARCHES IN USSR,
Moscow State Univ. (USSR).
For primary bibliographic entry see Field 02E.
W69-08913

7C. Evaluation, Processing and Publication

METHODS OF ESTIMATING MAXIMUM DISCHARGE OF GIVEN PROBABILITY,
Ministry of Melioration and Water Resources Management (USSR).
For primary bibliographic entry see Field 02E.
W69-08724

PROBLEMS OF NETWORK DISTRIBUTION AND EVALUATION OF THE METHODS BEST SUITED FOR HYDROMETRIC INVESTIGATIONS (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 07A.
W69-08734

OPTIMIZING CONJUNCTIVE USE OF GROUNDWATER AND SURFACE WATER,
Utah State Univ., Logan. Dept. of Civil Engineering.
For primary bibliographic entry see Field 06A.
W69-08742

STIFF DIAGRAMS OF WATER-QUALITY DATA PROGRAMMED FOR THE DIGITAL COMPUTER,
Geological Survey, Lawrence, Kans. Water Resources Div.
Charles O. Morgan, and Jesse M. McNellis.
Kans State Geol Surv Spec Distribution Publication No 43, 1969. 27 p, 3 fig, 1 tab, 3 ref, 4 append.

Descriptors: *Computer programs, *Data processing, *Hydrologic data, *Water quality, *Kansas, Water chemistry, Aqueous solutions, Water analysis, Chemical analysis.
Identifiers: *Stiff diagrams.

Stiff diagrams, pattern diagrams used in interpretation of quality-of-water data, are calculated and printed with the aid of GE 625 digital computer at the rate of approximately 170 per minute. A range of scales for the diagrams is specified for each group of data. Each complete analysis is diagrammed if the cations and anions balance within 2, 3, or 5%, depending upon the amount of dissolved solids. (Knapp-USGS)
W69-08748

FORTRAN IV PROGRAM FOR SYNTHESIS AND PLOTTING OF WATER-QUALITY DATA,
Geological Survey, St. Paul, Minn.; and Geological Survey, Lawrence, Kans. Water Resources Div.
Leverett H. Ropes, Charles O. Morgan, and Jesse M. McNellis.
Kans State Geol Surv Spec Distribution Publication No 39, 1969. 59 p, 8 fig, 1 tab.

Descriptors: *Computer programs, *Water quality, *Data processing, Hydrologic data, Chemical analysis, Water chemistry, Digital computers, Analytical techniques.
Identifiers: Water quality data processing, Data plotting.

A FORTRAN IV program synthesizes data from the U.S. Geological Survey's water-quality cards. Line-printer output consists of tables and 2 semilog graphs in which the distribution and the minimum, mean, and maximum values of selected group of data are given. The 2 graphs represent front and top orthographic projections of a 3-dimensional array of data. The user selects (1) up to 16 variables, (2) data sorting according to multiple criteria such as aquifer and ranges of values of selected variables, (3) ion concentration units, (4) order of plotting, (5) log scale of the graphs, and (6) option of top-view graph. The program is operational on the GE 635 computer at The University of Kansas Computation Center (program designation: ROPES) and the U.S. Geological Survey's IBM 360/65 program library disc (program designation: DO160). (Knapp-USGS)
W69-08749

MODIFIED PIPER DIAGRAMS BY THE DIGITAL COMPUTER,
Geological Survey, Lawrence, Kans. Water Resources Div.
Jesse M. McNellis, and Charles O. Morgan.
Kans State Geol Surv Spec Distribution Publication No 45, 1969. 36 p, 2 fig, 1 tab, 9 ref, 3 append.

Descriptors: *Computer programs, *Data processing, *Hydrologic data, *Water quality, *Kansas, Water chemistry, Aqueous solutions, Water analysis, Chemical analysis, Digital computers.
Identifiers: *Piper diagrams.

Piper diagrams, used as aids in interpreting quality-of-water data, are produced accurately and efficiently by a digital computer. The computer produces the 2 triangular cation and anion diagrams and a square-grid modification of the original diamond-shaped diagram. Seven diagrams comprise the output from a quality-of-water data group. Three diagrams are square and the points plotted represent program-assigned sample identification numbers, aquifer identification numbers, and average position by aquifer number, respectively. Four diagrams are triangles to include cation and anion representations with sample and aquifer identification numbers. (Knapp-USGS)
W69-08750

ON THE USE OF POWER FLOW MODELS FOR SYSTEM PLANNING AND OPERATIONS,
Bonneville Power Administration, Portland, Oreg.; and Wolf Management Services, Palo Alto, Calif.
William F. Tinney, and John Peschon.
Pap, Thirty-first Annu Amer Power Conf, Chica Ill, Apr 1969. 13 p, 3 fig, 2 tab, 20 ref.

Descriptors: *Power system operations, *Electri studies, Computers, Models, *Mathematical ana sis, *Optimum development plans, Planning, El tric power production, Transmission (Electric Electrical networks, Electric power dema Forecasting, Reliability, Economics, Bibliog phies.
Identifiers: *Systems engineering, *New Method, Load flow, Cost savings, Power syst stability, Optimum performance.

A description is given of recent research of n computer-based procedures for power syst planning and operation. The most common proach consists of running as many power-flow s dies as are believed necessary to ensure syst security and economy. Until recently, power-fl computations for large systems were slow, unrel ble, and costly. The introduction of Newto Method with ordered triangular factorization a special programming techniques has greatly creased the efficiency of these programs. Much this increased efficiency has been offset by many trial and error runs performed for the sake conscientiousness. Direct methods for analyz the optimizing phases of power system operati and planning are introduced. The computer p forms an organized and efficient search over a la number of alternatives and retains the optimum ternative. Direct methods can be formulated problems of mathematical programming in wh the power-flow equations enter as equality co straints. The power-flow model remains at center of all power system computations be developed. (USBR)
W69-08869

DIGITAL COMPUTER SIMULATION HYDROLOGY,
Geological Survey, Menlo Park, Calif. Wa Resources Div.
David R. Dawdy, and H. Terry.
Am Water Works Assoc Journ, Vol 59, No 6 685-688, Feb 1968. 4 p, 1 tab, 10 ref.

Descriptors: *Digital computers, *Comput models, *Hydrology, *Model studies, Hydrol cycle, Runoff, Streamflow, Parametric hydrol Measurement, Electronic equipment, D processing, Optimization, Watersheds (Basins)

Computers make it possible to simulate in mint the overall hydrologic cycle in much of its co plexity, in contrast with one of the earliest mo (Folse, 1929), which involved 41 people, took years to complete, and consumed over 34,000 r hours. The U.S. Geological Survey is deeply volved in hydrologic modeling; examples preser are directed toward streamflow runoff and ob tive criteria for fitting the model to a partic basin. The results of three optimizing runs at royo Seco near Pasadena, California, were tes If parameters are insensitive, the fitted values have little relation to true ones. A problem not investigated is the effect of errors in data upon e fitting process. If this valuable modeling tool be used to the best advantage, its weak points n be understood. (Affleck-Ariz)
W69-08893

08. ENGINEERING WORKS

8A. Structures

WATER RESOURCES DEVELOPMENT THE U.S. ARMY CORPS OF ENGINEERS NEW JERSEY.
Corps of Engineers, New York. North Atlantic

Corps Eng Water Resources Develop Rep, J 1969. 68 p, 3 fig, 21 photo, 1 map, 3 tab

scriptors: *Water management (Applied), ew Jersey, *Water resources development, igation, River basin development, Flood con-, Multiple-purpose projects, Hydroelectric ver, Dams, River training.
ntifiers: US Army Corps of Engineers projects).

Army Corps of Engineers water resources elopment projects in New Jersey are listed. The of the Corps of Engineers in planning and lding water resources improvements is cribed briefly, and the procedures for initiating h studies, authorization procedures, and status rojects are outlined. Projects described include igation, flood control, multiple-purpose pro-s, river surveys, erosion control, water supply, er pollution, power recreation, and flood plain dies. (Knapp-USGS)
9-08710

TER RESOURCES DEVELOPMENT BY E U.S. ARMY CORPS OF ENGINEERS IN ASKA, 1969.
rps of Engineers, Portland, Oreg. North Pacific

rps Eng Water Resources Develop Rep, Jan 9. 29 p, 2 fig, 12 photo, 1 map.

scriptors: *Water management (Applied), laska, *Water resources development, Naviga-, River basin development, Flood control, Mul-e-purpose projects, Hydroelectric power, Dams, er training, Bank stabilization.
ntifiers: U S Army Corps of Engineers projects as).

. Army Corps of Engineers water resources elopment projects in Alaska are listed. The role he Corps of Engineers in planning and building er resources improvements is described briefly, the procedure for initiating such studies, horization procedures, and status of projects are lined. Projects described include navigation, d control, multiple-purpose projects, river sur-s, erosion control, water supply, water pollu-, power, recreation, and flood plain studies. (K-p-USGS)
9-08718

Y PIPE TO A BEAM OF LIGHT TO REDUCE STS AND INCREASE SPEED AND ACCURA-

er City, Vol 83, No 10, p 105-110, Oct 1968. 3 fig, 3 photo.

criptors: *Pipelines, *Sewers, *Laser, Concrete s, Clay pipes, Pipes, *Surveying instruments, struction, Trenches, Surveying.
tifiers: *Pipe laying, *Light beams, Cost ngs, Accuracy.

ew laser system, used instead of conventional eying procedures, will reduce costs and in-se speed and accuracy when laying sewer pipe. instrument emits a precise beam of red light to h the pipe is laid by means of a special reflex et on a calibrated storey pole. A rear reference n aimed at a prismatic target that can be seen where along the trench line provides an instant continuous visual check on the alinement of instrument. The instrument can be used above nd or in the trench. Compared to the conven-al method of sewer construction, the laser m: (1) reduces stake-out and engineering ; (2) speeds construction because pipe can be closely behind the digging machine; (3) pro-s better accuracy because the beam of light not sag and pipe can be laid to precise line and e; and (4) reduces cave-ins, particularly in wet nd, because digging and laying pipe can be ac-plished in one continuous operation. (USBR)
-08834

EDWARD HYATT POWERPLANT INTAKE STRUCTURE,
Parsons, Brinkerhoff, Quade and Douglas, N.Y.
Paul H. Gilbert.
Proc Amer Soc Civ Eng, J Power Div, Vol 95, No PO1, p 101-118, Mar 1969. 18 p, 18 fig, 7 ref, append.

Descriptors: Corrosion control, Corrosion, Hydroelectric plants, Water quality, Hydroelectric power, Environmental effects, *Intake structures, Environmental engineering, *Intake gates, *Intakes, Hydraulic machinery, Penstocks, Pumped storage, Stainless steel, Structural steel, Hydraulic gates, *Temperature control, Powerplants, Trash racks.
Identifiers: Corrosion resistance, Corrosion resistant alloys, *Oroville powerplant (Calif).

A major component of the 644-megawatt Oroville Powerplant on the Feather River in California is the sloping, multilevel, temperature-controlling intake structure. This intake is capable of providing the powerplant with over 16,500 cfs of water. The intake provides temperature control of water passing through the powerplant and downstream. Control is required to avoid damage to downstream agricultural, recreational, and fishlife interests. The intake can vary the temperature of the powerplant discharge by as much as 25 deg F. Submerged portions of the intake are designed for a pressure differential of 5 ft of head. The low design of 5 ft was made possible by utilizing special relief panels built into the intake system, limiting effects of overpressure to less than the 5-ft value. Stainless steel was used as a structural material for the trashrack system, the first such use in a major hydroelectric installation. Corrosion resistance of this material makes it ideally suited for use in an application involving a corrosive medium, inaccessibility, and strict structural requirements. In this case, using stainless steel was the most economical solution. (USBR)
W69-08836

VIBRATION ANALYSIS OF PUMP DISCHARGE LINES,
California State Dept. of Water Resources, Sacramento; and Development and Water Resources Corp., Sacramento, Calif.
Jesse M. Diaz, and Ravinder K. Jain.
Pap, Amer Soc Civ Eng Nat Meet Water Resour Eng, New Orleans, La, Feb 1969. 40 p, 6 fig, 1 tab, 16 graph, 6 ref, append.

Descriptors: *Discharge lines, *Pumps, Pumping plants, *Vibrations, Resonance, Pipelines, Natural frequency, Pressure, Kinetic energy, Velocity, Oscillation, Deflection, Analysis.
Identifiers: *Pipeline surges, *Stiffeners, *Vibration control, Amplitude, Propagation.

A method for determining the critical spacing for stiffener rings on exposed pump discharge lines under internal pressure is outlined. The analysis includes all parameters affecting the natural frequency of a discharge line. Using stiffener rings is not the only method of preventing vibrations in discharge lines, but is normally the most convenient for controlling or correcting vibrations in existing installations. Stiffener rings are assumed to act as simple supports that are free to rotate. This assumption is conservative and results in no great sacrifice to the economy of the project. Calculations made on the basis of a shell of infinite length whose bending stiffness is determined by the stiffeners acting with an effective length of the shell indicate the cross-section size of required stiffeners to be smaller than practical from a fabrication standpoint. Stiffeners rectangular in cross section that are large enough to satisfy fabrication requirements should be used, the minimum size being approximately 6 in. by 1/2 in. A criterion for avoiding resonant conditions in pipelines is given. (USBR)
W69-08838

HIGH ARCH DAMS IN THE WEST; MODERN TRENDS AND STATE OF THE ART,
International Engineering Co., Inc., San Francisco, Calif.
Gurmukh S. Sarkaria.
Pap, West Water Power Symp, ASCE, ASME, IEEE, p A-135-A-151, Apr 1968. 17 p, 9 fig, 1 tab, 9 ref.

Descriptors: *Arch dams, *Concrete dams, Concrete construction, Stress analysis, Concrete placing, Safety, Safety factors, *Dam design, Design criteria, Foundation investigations, Monoliths, Spillways, Underdrains, Geometric shapes, Engineering geology, Lifts (Construction), Mass concrete, Dam foundations, Aesthetics.
Identifiers: *Western United States, Double-curvature arch dams, Site selection, Design practices, Bullards Bar (Calif), Allowable stress.

Seven arch dams over 350 ft high have been built in the Western United States during the last 11 yr. Current trends indicate better utilization of wider and unsymmetrical sites, acceptance of higher stresses, and greater reliance on the inherent structural stability of an arch dam. A well-engineered arch dam with adequate foundation support, in comparison with other types, has substantially larger overall margins of safety against failure caused by structural rupture, leakage through the dam, and accidental or planned overtopping of either the fully or partially completed structure. Structurally, the arch represents the most economical and effective utilization of concrete and its strength properties to develop a safe dam. Recent emphasis on aesthetics of public facilities has enhanced prestige of the arch dam because it is unmatched for elegance, graceful lines, and beauty. Other factors that reflect present, and will influence future, arch dam engineering practices are the recognition of such advantages of this type of dam as simpler river diversion, safe overtopping during construction, shorter penstocks through the dam, and the possibility of storing water behind a partially complete dam. New Bullards Bar Dam in California is a typical example of current design and construction practices. (USBR)
W69-08865

8B. Hydraulics

ON THE REFLEXION OF WAVE CHARACTERISTICS FROM ROUGH SURFACES,
Oregon State Univ., Corvallis.
M. S. Longuet-Higgins.
J Fluid Mech, Vol 37, Part 2, p 231-250, June 23, 1969. 20 p, 12 fig, 10 ref. Supported by grant from NSF.

Descriptors: *Waves (Water), *Refraction (Water waves), *Roughness (Hydraulic), Energy, Frequency, Wavelengths, Mathematical studies, Viscosity, Turbulence, Shear, Mixing, Absorption.
Identifiers: *Water wave reflection.

The energy of internal waves tends to be propagated alon certain characteristic paths inclined at fixed angles to the vertical direction, depending only on the wave frequency and the density stratification, not on the wavelength. The role of surface roughness is examined. It appears that small-scale irregularities can completely alter the reflecting properties of a surface; the tangential scale of the roughness elements may be much smaller than the wavelength of the incident or reflected waves. All scales of roughness are relevant, down to those comparable in magnitude to the thickness of the oscillatory boundary layer. For tidal waves in the ocean this thickness is of the order of 1 m. The behavior of the coefficient of transmission as a function of the angle of incidence appears at first sight to be extremely complicated. Some simple examples of periodic surface roughnesses are discussed and elucidated: a sawtooth, a square-topped wave and a simple sine wave. An approximate expression is also derived in the case of a slowly modulated sine wave. These results are for a non-viscous fluid. The effects of

viscosity are also considered qualitatively. (Knapp-USGS)
W69-08717

SURFACE TENSION IN FROUDE MODELS,
Illinois Univ., Urbana.
W. Maxwell, Richard J. Weggel, and C. Hall.
Proc Amer Soc Civ Eng, J Hydraul Div, Vol 95, No HY2, p 677-701, Mar 1969. 25 p, 9 fig, 1 tab, 8 ref, 3 append.

Descriptors: *Froude number, *Surface tension, Fluid flow, Hydraulics, *Hydraulic models, Reynolds number, Viscosity, Spillways, Free surfaces, Weber number, Weirs, Vee-notched weirs, Rectangular weirs, Uniform flow, Experimental data, Energy equation.
Identifiers: Experimental models, Ogee crests, Bureau of Reclamation, Surface energy, Corps of Engineers.

A criterion for avoiding surface tension effects in Froude models is obtained analytically for uniform flows. Experiments show that surface tension does not limit the scale in curvilinear flow Froude models. In uniform flows, the least scale is determined by instrumentation accuracy and Froude number or by the need to exceed a limiting Reynolds number. The least scale is found by including a surface energy term in the energy equation or by considering the celerity of small free-surface disturbances. The scale is chosen so that experimental reading error scatter will mask any dependence on surface tension. Experiments on 3 weir geometries, for which flow at one head is interpreted as an imperfect Froude model of flow at a different head, are used to examine surface tension effects in Froude models of curvilinear flows. The viscosity was kept nearly constant and the surface tension varied using an additive. Variations caused by surface tensions are masked by the inherent scatter of data. (USBR)
W69-08851

SURGE STUDIES FOR PORTAGE MOUNTAIN TAILRACE SYSTEM,
Ingledow (T.) and Associates Ltd., Vancouver (British Columbia).
Kenneth C. Wilson.
Proc Amer Soc Civ Eng, J Power Div, Vol 95, No PO1, p 1-16, Mar 1969. 16 p, 7 fig, 1 ref, 2 append.

Descriptors: Hydraulic models, Hydraulics, Hydroelectric plants, Hydroelectric power, *Open channel flow, *Surges, *Tunnels, Head loss, *Waves (Water), Discharge (Water), Discharges, Digital computers, Foreign research, Laboratory tests, Hydraulic transients.
Identifiers: *Surge waves, *Portage Mtn Pwrplt (Can), Traveling waves, Canada, Foreign testing, Test results.

The discharge from the underground powerhouse at Portage Mountain, Canada, rejoins the Peace River through 2 large free-flow tunnels. Surge waves in these tunnels, caused by changes in turbine discharge, were studied by: (1) approximate manual calculations, (2) computer analysis, and (3) model testing. The surges are considered under 2 headings: determination of the initial extreme level following a flow change, and the more complicated conditions occurring after the return of surge waves reflected at the tunnel exit. Procedures used for manual and computer calculations are based directly on the momentum and continuity relationships because the great variation in surface breadth with the water level precludes using standard methods for surges in open channels. The tunnels are hydraulically short, permitting the configuration to be approximated by a level tunnel with friction losses lumped at the entrance and exit. Comparing results of the 3 methods of surge study indicates very satisfactory agreement. (USBR)
W69-08852

HYDRAULIC PERFORMANCE OF PENSTOCK TRIFURCATIONS,
Roorkee Univ. (India); and Birla Inst. of Technology and Science, Pilani (India).
Palepu V. Rao, H. C. Misra, and R. V. Juyal.
Proc Amer Soc Civ Eng, J Power Div, Vol 95, No PO1, p 35-53, Mar 1969. 19 p, 18 fig, 4 tab, 9 ref, 2 append.

Descriptors: *Penstocks, Energy dissipation, Energy losses, Models, *Hydraulic design, Hydraulic conduits, Hydraulics, Pipe bends, Model tests, Pressure distribution, Reynolds number, Velocity distribution, Cavitation, Foreign research.
Identifiers: Test results, *Trifurcations, Foreign testing, India.

Pressure distributions and energy losses were obtained in an air tunnel for the following penstock trifurcations: a 2-wye arrangement, 2 types of plug-funnel proposal, and an abrupt junction. Results of model studies of the tie bar trifurcation and other wyes are included to provide a comprehensive aid in selecting the right type of trifurcation. Model tests were made for 3 operating conditions: one branch flowing, 2 branches flowing, and all 3 branches flowing. Within the range of Reynolds numbers tested, the coefficients of the energy loss are independent of the Reynolds number. The plug-funnel trifurcation (central portion recessed) is hydraulically better than the other models tested when all 3 branches are flowing because the boundary geometry provides a smooth entry into all 3 branches. The double wye is superior when only one branch is flowing. (USBR)
W69-08853

8C. Hydraulic Machinery

THE PROBLEM OF FRAZIL ICE IN WATER INTAKES,
Laval Univ., Quebec.
B. Michel.
Pap, Univ Laval, Can, 15 p, 1963. Transl from Fr, Bur Reclam Transl 698, Apr 1967. 21 p, 11 fig, 9 ref.

Descriptors: *Frazil ice, Water temperature, *Intakes, Grills, *Intake structures, *Trash racks, Research and development, Heating, Hazards, Screens, Hydroelectric plants, Hydraulic turbines, Turbines, Foreign research.
Identifiers: Electric heating, Canada, Clogging.

Frazil ice can be a serious hazard to the operation of hydroelectric powerplants. Studies were made at Laval University, Canada, on the nature of frazil ice and methods of combatting it. Frazil ice can obstruct intakes by: (1) adhering as active frazil (frazil in the early stage of formation) to trashracks and grillwork, even to the bottom of the intake structure; (2) blocking as inactive frazil (older frazil that has lost its adhering characteristics but has formed into larger flakes and small plaques of ice) the partially obstructed openings by arching action; and (3) progressively clogging the turbines with active and, later, inactive frazil and producing shutdown of the hydroplant for the winter. Reservoir intakes should be located beneath the water in a manner to avoid frazil that could appear because of wind effect before surface icing. River intakes should not be located in rapids or immediately below rapids where frazil could form beneath a partial ice cover. Trashracks and grillwork should be equipped with heating capability for operation well before the appearance of active frazil ice. (USBR)
W69-08856

ON THE USE OF POWER FLOW MODELS FOR SYSTEM PLANNING AND OPERATIONS,
Bonneville Power Administration, Portland, Oreg.; and Wolf Management Services, Palo Alto, Calif.
For primary bibliographic entry see Field 07C.
W69-08869

THE INFLUENCE OF STATION DESIGN C CONTROL CIRCUIT TRANSIENTS,
General Electric Co., Philadelphia, Pa.
W. C. Kotheimer.
Pap, Thirty-first Annu Amer Power Conv, A 1969. 18 p, 4 fig, 10 ref.

Descriptors: *Extra high voltage, *Substatio (Electrical), Control, *Electromagnetic wav Switchyards (Electrical), Electromagnetic shie ing, *Interference, Circuits, Electric relays, B (Electrical), *Transients, *Electrical design, Co ductors, Magnetic fields, Shielding, Electric grounding.
Identifiers: *Ultra high voltage, *Induced voltag Switching surges, Control equipment, Protecti (Electrical), Magnetic links.

In ehv substations, interference originating duri operation of a switching device can cause prote tive and control equipment to be damaged or operate falsely. This phenomenon is electroma netic interference, and control circuit transie present during switching operations have be measured in the thousands of volts. Fundamen principles of electromagnetic interference a discussed, relating them to factors in station desi that can be manipulated to minimize control circ transients. The 4 basic conditions that must present to cause electromagnetic interferenc surges, or control circuit problems are reviewe Station design, proper shielding of control circui and coupling between ehv circuits and control c cuits are very important as system voltages increa to the 765- and 1000-kv level. Transients in contr circuits have been related in severity to the thi power of the system voltage; transient levels 1000-kv stations could be 8 times those present 500-kv stations unless additional precautions a taken during design. (USBR)
W69-08870

SHUNT REACTOR COMPENSATION (PRESENT AND FUTURE TRANSMISSIO SYSTEMS,
General Electric Co., Schenectady, N.Y.
J. M. Feldman, and D. D. Wilson.
Pap, Thirty-first Annu Amer Power Conf, A 1969. 15 p, 9 fig, 9 ref, append.

Descriptors: *Reactance, Compensation, *Trar mission lines, Testing, Transmission (Electrica *Extra high voltage, Extra long distanc Economics, Maintenance costs, Installation cos Analysis, Electric relays, Technology, Electric design.
Identifiers: *Shunt reactors, Overvoltage, *Ult high voltage, Switching surges, Protection (Elect cal).

Shunt reactor technology, including design, testi and application, is very important in the investme and operation of ehv and uhv transmission syster The transmission voltage levels employing compe sation cover the spectrum from 115 kv through 7 kv, with the majority of the approximate 15,000,000 kvar of installed or planned reacto applied on 345-kv and 500-kv systems. Reactor a plications are almost evenly divided between inst lations at line voltage and reactors on tertia windings of transformers, normally transmission-autotransformers. Continuing requirements shunt reactors indicate the necessity of defining a plication and testing practices and the econom of various compensation schemes. An analysis o reactor installation is given, indicating the necess of economic analysis when applying shunt compe sation. System requirements, reactor design, re tor testing, switching protection, and installat economics are discussed. (USBR)
W69-08871

8D. Soil Mechanics

EARTH STRUCTURES AND FOUNDATIO SUBJECT TO SEISMIC LOADING,
Bureau of Reclamation, Denver, Colo.
H. J. Gibbs.

U S-Jap Coop Program Natur Resour
), Tokyo, Japan, Apr 1969. 19 p, 11 ref.

ptors: Seismic design, Seismic investigations,
c studies, Seismic properties, Soil density,
lynamics, Shear strength, *Soil liquefaction,
ve soils, Cohesionless soils, Foundations,
e density, Earthquake engineering, Penetra-
esistance, Soil strength, *Foundation in-
tions, Soil mechanics, Shear tests, Saturated

iers: *Earthquake loads, In situ tests, Satu-
and.

arge number of studies concerning soil
or during earthquakes has yielded new con-
n investigation and design of earth structures
undations. Liquefaction is a critical problem
density sands and silts when saturated and a
anger during earthquakes. The foundation
er must determine the critical nature of in
onditions. The standard penetration-re-
e test is useful for evaluating relative density
d deposits and checking this condition after
cation. Laboratory tests of sands at various
ions, using cyclic loads and the number of
to represent earthquake effects, may be per-
d to determine shear stresses necessary for
action and failure. Seismic coefficients and
earthquakes are selected from a review of
rthquake history in the construction area to
ate expected shear stresses for comparison
near stresses necessary to cause liquefaction.
racticing foundation engineer is concerned
with acceptable densities in sands susceptibi-
liquefaction and cohesive soils compacted in
kments. Details of laboratory tests and
es provide variable limits of this property for
nt depths and types of soils. (USBR)
8839

CTS OF ENVIRONMENT ON THE PER-
IANCE OF SHALLOW FOUNDATIONS,
al Research Council of Canada, Saskatoon
tchewan).
amilton.
eotech J, Vol 6, No 1, p 65-80, Feb 1969. 16
ig, 14 ref.

ptors: *Environmental effects, Environment,
environment, *Foundations, Stress distribu-
Foundation investigations, Swelling, Soil
movement, Soil mechanics, Soil moisture,
roperties, Soil treatment, Expansive clays,
sive soils, Construction, Thermal insulation.
iers: Soil moisture movement, Swelling pres-
Construction methods.

ations for most structures have an important
ary function as part of the total building en-
. When placed on subsoils sensitive to
re changes, a separation of environments
e achieved without jeopardizing the primary
ment of stability. A general understanding
nges in stress and moisture conditions im-
on subsoils by various structures is a
uisite for satisfactory foundation design.
l of heat and moisture flow in subsoils can
eved by using insulation and vapor barriers.
y situations, these are most effective when
on the outside of the foundations and should
alled at early stages of construction. Large
increases result from relatively small reduc-
confining pressure on swelling clays. These
extend deeply into the underlying soils and
be corrected by shallow treatments. Addi-
arge volume changes may also occur when
oted vegetation is removed and water is
le. Establishment and maintenance of
bly uniform stress and moisture conditions
subsoils are principal requirements for
tory performance of shallow foundations.
)
847

MINATION OF LATERAL PRESSURES
IATED WITH CONSOLIDATION OF
LAR SOILS,
of Public Roads, Washington, D.C.
Vladimir F. Obrcian.
Pap, U S Dept Transp, Fed Highw Admin, Bur Public Roads, Jan 1969. 31 p, 13 fig, 2 tab, 13 ref.

Descriptors: *Consolidation, *Cohesionless soils, Soil tests, Poisson ratio, Soil properties, *Soil compression tests, Soil density, Friction, Soil mechanics, Laboratory tests, Test procedures, Prestressing, Stress, Strain, Loading rate, Preconsolidation.
Identifiers: *At rest pressure, Consolidometers.

One-dimensional consolidation of 4 granular soils was studied to determine the coefficient of earth pressure at rest, k sub zero. The consolidation apparatus permits gradual load application at a specified rate, while vertical and lateral stresses are observed simultaneously under the controlled condition of no lateral yielding. Load history of the deposit was simulated by vertical loading and unloading cycles. The soil specimens had a range of gradations and compactness commonly encountered in natural soils. Data demonstrate that k sub zero is less for the dense state than for the loose state and that it decreases with higher consolidation stress levels. Influence of gradation is also apparent from the results, but less pronounced. Approximate values of Poisson's ratio were computed from the data. The stress history studies, simulated by performing a number of unload and reload cycles starting at 3 different consolidation stress levels, demonstrated the locked-in or residual stress phenomenon associated with consolidation of soils subjected to cyclic loading. These studies emphasize the importance of considering the stress conditioning of soils that may be caused by the rolling of embankments or pavement layers. (USBR)
W69-08850

ANALYSIS AND DESIGN OF TOWER FOUNDATIONS,
Texas Power and Light Co., Dallas.
Richard L. Wiggins.
Proc Amer Soc Civ Eng, J Power Div, Vol 95, No PO1, p 77-100, Mar 1969. 24 p, 12 fig, 8 ref, 2 append.

Descriptors: *Footings, Foundations, *Transmission towers, Analysis, *Design criteria, Compression, Horizontal loads, Lateral forces, Soil mechanics, Testing, Reinforced concrete, Substations (Electrical), Cohesive soils, Soil pressure, Soil tests, Loads (Forces), Cohesionless soils, Transmission lines.
Identifiers: Uplift footings, *Auger-type footings, *Belled footings.

A comprehensive set of design procedures for drilled shaft-type tower foundations is presented. An analysis of various soil types, soil testing procedures, and interpretation of field and laboratory test results is included. Procedures are developed separately for horizontal shear, compression, and uplift in various soil types. The structural design of the reinforced concrete shaft for combined uplift and bending is presented as well as cases involving compression at extremely high eccentricities. Computer-generated design aids are presented, offering some relief from tedious calculations. Two simple design problems illustrate the developed procedures. The material and procedures presented should help in analyzing and designing foundations for transmission lines and substations. (USBR)
W69-08854

UPLIFT TEST ON AN ANCHOR BAR FOOTING - MEAD-LIBERTY TRANSMISSION LINE - PACIFIC NORTHWEST-PACIFIC SOUTHWEST INTERTIE,
Bureau of Reclamation, Denver, Colo.
James M. Horner.
Bur Reclam Rep No EM-765, Feb 1969. 38 p, 23 fig, 7 tab, 4 ref.

Descriptors: Foundations, Penetration resistance, Field tests, Shear strength, Soil properties, *Footings, Construction, Cohesive soils, Transmission towers, *Movement, Soil mechanics, Soil tests, Inspection, Loads (Forces), Arizona, *Loading rate.
Identifiers: Pacific Northwest-Southwest Intertie, Uplift resistance, Mead-Liberty Transmission Line, Anchored footings, Loading tests.

A full-size test to determine the movement of an anchor bar transmission tower footing under load was performed near Kingman, Ariz. The anchor bar footing consists of a reinforced concrete cap with 4 anchor bars (reinforcing bars surrounded by grout) extending out of the cap base downward into the soil. At the failure movement of 1/2 in., the uplift load was about 30 kips and the maximum uplift load resisted was 48 kips. Most footing movement was caused by rotation rather than translation. The soil resisting the footing movement was a sandy silt and a lean clay. For an individual anchor bar, soil strength values indicated that about 3.5 kips could be resisted, while a static analysis indicated that about 8.2 to 10.7 kips were actually resisted. The difference between computed and actual loads is attributed mainly to the following factors not included in the computations: (1) the direction of the load was oblique to the axis of the anchor bar, and (2) a 1-1/2-ft section of the grouted hole in a sand and gravel layer had an enlarged diameter. The analysis was complicated because the bottom one-third to one-half of the anchor bar reinforcements extended into soil outside the grouted holes. (USBR)
W69-08857

STABILITY OF DAMS IN PERMAFROST AREAS,
Alaska Univ., College.
Donald J. Gotschall.
Pap, Arctic Eng Class, Univ Alaska, Dec 1968. 14 p, 1 fig, 7 ref.

Descriptors: *Permafrost, Frost, Frost action, Frost heaving, Frozen ground, Frozen soils, Dam construction, Dam design, *Earth dams, Outlet works, *Rockfill dams, Heat flow, Dam foundations, *Stability, Cold weather construction, Spillways.
Identifiers: *Frozen core dams, USSR, Norway, Canada.

Stability of earth or rockfill dams built in permafrost areas requires that as much attention be given to the heat flow through a dam as is given to stopping the flow of water through a conventionally built dam. Heat flowing around abutments or through a frozen foundation will result in thawing the ice-soil mixture into a liquified state and invite failure. Earth dams have been built successfully in the arctic with and without frozen cores and on frozen and unfrozen foundations. Examples are given of permafrost dams built in the U S, Canada, Russia, and Norway. From the limited experience throughout the world, stability of earth and rockfill dams in a permafrost area is not an insurmountable problem. Heat flow through a zoned earthfill dam can be analyzed with an instrumented model or an analog computer. Rockfill can be used in the contact between frozen and thawed zones since rockfill drains easily and is not subject to movement when frozen. Other unusual construction and design techniques that have been used in permafrost are discussed. (USBR)
W69-08862

SLOPES IN STIFF-FISSURED CLAYS AND SHALES,
California Univ., Berkeley.
James M. Duncan, and Peter Dunlop.
Proc Amer Soc Civ Eng, J Soil Mech Found Div, Vol 95, No SM2, p 467-492, Mar 1969. 26 p, 20 fig, 3 tab, 44 ref, 2 append.

Descriptors: *Clays, Overconsolidation, Safety factors, *Shales, Shear stress, *Slope stability, Soil mechanics, Shear strength, Displacements, Stress analysis, Fissures, Computer programs, Normal stress, Pore pressure, Bibliographies, *Slopes.
Identifiers: Progressive failures, At rest pressure.

Case histories and probable causes of slope failures in stiff-fissured clays and shales are reviewed; analyses for determining the influence of initial stress conditions on stresses around excavated slopes are described. These analyses show that initial horizontal earth pressures have considerable influence on the magnitudes of shear stresses following construction. Shear stresses around excavated slopes are much larger for conditions representing a heavily overconsolidated clay (high initial horizontal stresses) than for conditions representing a normally consolidated clay (low initial horizontal stresses). Results indicate that shear stresses large enough to cause failure may develop at some points within the slopes, even though the factor of safety (according to the usual phi sub u= zero method) is considerably greater than unity. The higher the horizontal stresses before construction, the higher the factor of safety corresponding to development of local failure around the slope. The existence of high horizontal stresses in heavily overconsolidated clays and shales increases the probability of progressive failure in these materials. (USBR)
W69-08874

CORRELATION OF RAPID HYDROMETER ANALYSIS FOR SELECT MATERIAL TO EXISTING PROCEDURE LDH-TR-407-66,
Louisiana Dept. of Highways, Baton Rouge.
George W. Bass, and Marrion M. Cryer, Jr.
Res Proj No 67-1S, La Dept Highw, May 1968. 17 p, 6 tab, append.

Descriptors: *Gradation, *Gradation analysis, *Grain sizes, Base courses, *Hydrometers, Soil tests, Soil texture, Soil treatment, Soil classifications, Soil cement, Soil physical properties, Soil mechanics, *Laboratory tests, Statistical analysis, Soil stabilization, Test procedures.
Identifiers: Cement content.

The Louisiana Department of Highways has developed a standard procedure for rapid hydrometer analysis of soil samples to determine particle size distribution. The procedure will provide information in 24 hr instead of the 2-1/2 days required for former methods. Particle size distribution is needed for determining cement content for portland cement stabilized bases. The procedure requires removing material retained on the No. 4 and No. 10 sieves. Standard 100-g samples are ovendried and then mixed by hand with a stock solution of sodium hexametaphosphate buffered with sodium carbonate. The sample is washed into the dispersing cup and distilled water added. Dispersion by a mechanical stirring apparatus for 5 min precedes pouring the sample into 1000-ml sedimentation cylinders. Hydrometer readings are taken at 60 and 120 min. The sample is then washed over No. 40 and No. 200 mesh sieves and the retained material dried and weighed. Comparison with the standard laboratory method indicates equal accuracy and repeatability. (USBR)
W69-08875

EFFECTS OF WASTE EFFLUENTS ON THE PLASTICITY OF EARTH MATERIALS,
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 05C.
W69-08955

8E. Rock Mechanics and Geology

PREVENTING QUARRY ROCK FALLS,
R. M. Belliveau.
Pit Quarry, Vol 61, No 9, p 130-134, Mar 1969. 5 p, 6 photo.

Descriptors: *Rock excavation, *Rockslides, Quarries, *Quarrying, Rock properties, Mining engineering, Sliding, Slopes, *Engineering geology, Slope stabilization, Landslides, Geologic investigations, Safety.
Identifiers: *Rockfalls, *Rock slope stability, Rock competency, Open pit mining, Geologic defects, Benches.

Initial planning of quarry layout and operations is essential in preventing rock falls. Rock falls are manmade, resulting from deficient planning and inefficient operation. Geologic and mining engineering aspects are discussed for safe quarrying. Slides are usually caused by discontinuities in rock formations, such as bedding and faulting. Blasting disturbs the rock and induces slides. Operating practices are responsible for most situations resulting in slides and rock falls. Bench heights of 30 ft are recommended for ordinary operations; heights over 50 ft should not be used unless required by special considerations. In well-designed operations, the cost of mining high benches is greater than mining benches of 30 ft maximum height. (USBR)
W69-08833

NUCLEAR LOGGING METHODS,
Mobil Research and Development Corp., Dallas, Tex.
For primary bibliographic entry see Field 07B.
W69-08841

ANCHORAGE PERFORMANCE IN ROCK BOLTING,
Pennsylvania State Univ., University Park.
R. Stefanko, and D. S. Choi.
Prepr 69-F-61, Annu Meet Amer Inst Mining, Washington, D C, Feb 1969. 23 p, 9 fig, 7 ref

Descriptors: *Rock bolts, Rock mechanics, Roof supports, Coal mines, Rocks, *Underground structures, Slipping, Suspension, Friction, Field tests, Laboratory tests, Design criteria.
Identifiers: Expansion bolts, Rock grip resin pack, Pull-out tests, Anchor bolts, Underground openings, Suspended structures.

Laboratory, field, and analytical investigations are described for designing rock bolts for a suspended monorail transportation system in an anthracite mine. Theoretical analysis of expansion shell anchorage was made to determine the yield of rock, the friction on the interface between the plug and expansion shell leaves, and the friction between the rock and leaf serrations. Serrations on the surface of expansion leaves increase friction, but may produce high stresses in the rock, causing failure and subsequent slippage. The analysis shows that the spacing between serrations is too small in most commercial shells. Laboratory tests gave widely varying bleedoff and installed load values for different rock and shell combinations, and substantiated the theoretical analysis that a reversal of serrations would improve anchorage. The variability in underground conditions prevents assessment of design parameters; field tests are necessary. With the present state of the art, pull tests and long-term bleedoff studies are essential for determining the best bolt assembly for a specific application. Field tests are discussed for roof bolts suspending the underground monorail, and bolt performance is being monitored periodically during operation.
W69-08858

8F. Concrete

RECOMMENDATIONS FOR CAST-IN-PLACE NONREINFORCED CONCRETE PIPE,
Ernest C. Fortier, Lawrence J. Booher, and Noel A. Negley.
J Amer Concr Inst, No 4, Proc V 66, p 252-269, Apr 1969. 18 p, 13 fig, 2 tab, 20 ref.

Descriptors: *Concrete pipes, Concrete placing, Concrete mixes, *Cast-in-place structures, Backfill, Pipelines, *Water pipes, *Trenches, Storm drains, Sewers, Excavation, Bibliographies, Inspection, Design criteria, Safety, Design data, Construction equipment, Curing, Concrete control, Formwork (Construction).
Identifiers: *Cast-in-place pipes, (Pipe d
Construction methods, Pipeline surges, Con
tion practices.

Present knowledge of nonreinforced cast-in-
concrete pipe is reviewed by American Co
Institute Committee 346. Recommendation
given on design, construction, inspection,
safety precautions. Load tests and structural a
sis show that nonreinforced concrete pipeline
sustain loads normally encountered by irrig
lines and sewers. Design recommendations ar
vided for pipeline locations, radius of curv
coefficient of friction, protection against s
and water hammer, maximum surcharge
foundation support, and pipe dimensions.
struction recommendations are included
trenching, concreting, and backfilling. Single-
and 2-stage construction methods are descr
(USBR)
W69-08849

**SKEW REINFORCEMENT OF CONCR
SLABS AGAINST BENDING AND TORSIO
MOMENTS,**
Engineering Labs., Cambridge (England).
C. T. Morley.
Inst Civ Eng Proc, Vol 42, p 57-74, Jan 1969
7 fig, 4 tab, 10 ref.

Descriptors: *Reinforced concrete, *Reinf
ment, *Torsion, *Slabs, Load factors, *Be
moments, *Structural design, Plastic theory, E
ing, Design, Design tools, Reinforcing
Foreign research, Stress.
Identifiers: *Skewness, Limit analysis.

A method is described for proportioning steel
forcement in given, possibly skew, directions
sist bending and torsional moments at a poin
concrete slab. A formula is obtained fo
strength of an under-reinforced slab with k
areas of steel; this formula is then used to fin
reinforcement necessary to resist a given s
bending and torsional moments, using
minimum total amount of steel. The metho
sumes that: (1) concrete has no tensile stre
(2) bar diameters are small in comparison wit
depth, (3) the slab is to be under-reinforced s
ductile failures will occur, and (4) the bar
carry stress only along their original axes. The
approach is to use plasticity theory and limit a
sis, and consider the ultimate strength of a
forced concrete slab element subjected to be
and twisting moments. Steel is provided i
cordance with the so-called load factor meth
beam design to resist the elastic moment dis
tion according to the lower bound theorem o
analysis. Sample design charts are presente
the design process is described for a single
moments and for multiple sets due to dif
loading cases. (USBR)
W69-08861

**CORRELATION OF RAPID HYDROM
ANALYSIS FOR SELECT MATERIAL TO
ISTING PROCEDURE LDH-TR-407-66,**
Louisiana Dept. of Highways, Baton Rouge
For primary bibliographic entry see Field 08D
W69-08875

8G. Materials

**GALVANIC ACTION OF NEW LIQUID M
PRIMER GIVES LASTING PROTECTION,**
Ricallis Engineering Ltd, Manchester (Engla
R. H. Herford.
Anti-Corros Methods Mater, Vol 16, No 2,
19, Feb 1969. 3 p, 3 fig.

Descriptors: *Protective coatings, *Primers (
ing), Paints, Metal coatings, Zinc, Corrosion,
rosion control, Maintenance, Steel pipes, Ca
protection, Steel structures, Metalwork.
Identifiers: Zinc pigmented paints, Corrosi
hibitors, Corrosion currents, Galvanic protec
systems, Great Britain, Foreign products.

attempts have been made to develop zinc-
aints for protecting steel from corrosion.
ch paints provide the reactions of cathodic
tion, but are more convenient than zinc
in cathodic protection systems. Early ex-
ces indicated that zinc did not react suffi-
with steel; a catalyst would be needed. Stu-
the problem led to the development of a
metal primer. This primer contains other
than zinc, such as chromium and cadmium,
are anodic to steel, and also may be added to
um. The metals are carried in a high-grade
mer in a single solution of brushing con-
y. When applied to steel, a cell is formed in
the primer is the anode, the steel is the
e, and ambient moisture is the electrolyte.
rable currents are generated, overcoming
rrosion currents. The primer expands and
cts with the steel; no cracking or crazing
lace. Japanese and British experiences with
metal primer are discussed. (USBR)
8837

CONOMICS OF CORROSION AND COR-
N CONTROL,
me.
orros Methods Mater, Vol 16, No 2, p 12-
1969. 5 p, 3 fig, 8 ref.

ptors: *Corrosion, *Corrosion control,
*Cost comparisons, *Cost analysis, Ac-
ng, Economics, Investment, Capital costs,
(Monetary), Foreign design practices, Pro-
coatings, Discount rate, Monctary benefits.
iers: Repayment, Great Britain.

conomic effects of corrosion of metals in
Britain and the U S are reviewed; accounting
ds are presented for evaluating the true costs
osion control. Corrosion control is an invest-
hat may be appraised by the methods of in-
nt appraisal used by accountants and
nists. The main methods of appraising in-
nt projects are: (1) payback, (2) annual rate
rn, and (3) discounted cash flow. Each
l is described and examples are given for
ring costs of corrosion protection systems.
ion control methods are analyzed to show
cts on the national economy. (USBR)
8860

DESIGNING FOR CORROSION RESISTANCE,
Du Pont de Nemours (E. I.) and Co., Wilmington, Del.
R. James Landrum.
Chem Eng, p 118-124, 172-180, Feb-Mar 1969. 9 p, 22 fig, 7 ref.

Descriptors: Corrosion, *Corrosion control, Design, Butt joints, Steel structures, Fillet welds, Design criteria, Materials engineering, Steel, Materials failures, *Welding, Stainless steel, Temperature, Fabrication, Heat treatment, Fluids, Lap joints.
Identifiers: Corrosion environments, Corrosion resistance, Galvanic corrosion, Design practices, *Welds.

Corrosion resistance and service life under corrosive conditions are affected by construction materials, specifications, fabrication and inspection, operation, maintenance, and design. Service life is usually estimated from the corrosion resistance of the materials selected as determined by corrosion tests. Too little attention is paid to the effects of design details and other factors influencing corrosion, which can lead to early failures. A careful study of designs can detect design defects and find ways to avoid corrosive situations. Design details affecting corrosion are crevices, welding procedures, galvanic couples, heat treatment, environment, fluid drainage, velocity, and temperature. Designing for adequate performance at the lowest cost requires good judgment from the designer and the materials engineer. The materials engineer should work closely with the designer in selecting materials and design details to assure corrosion resistance. (USBR)
W69-08872

8H. Rapid Excavation

SUCCESSFUL OPERATION OF THE HABEGGER TUNNEL-BORING MACHINE IN HARD ROCK,
Habegger Machine Manufacturing Corp.
E. Lauber, and H. W. Brodbeck.
Schweiz Bauztg, Vol 86, No 51, p 917-924, Dec 1968. Transl from Ger, Bur Reclam Transl 812, Apr 1969. 21 p, 14 fig, 2 tab.

Descriptors: Tunnels, *Tunneling machines, *Tunneling, Engineering geology, Hardness tests, *Tunnel construction, Rock excavation, Slates, Rock properties, Rocks, Geologic investigations, Hardness, Conveyors, Quartz, Muck, *Boring machines, Foreign construction, Pressure tunnels, Sandstones.
Identifiers: Switzerland, Juliawerk Tiefencastel Proj (Switz), *Cutters.

The Habegger hard-rock tunneling machine was used in boring the high-pressure water tunnel for Juliawerk Tiefencastel Project, Switzerland. Experiences in tunneling, machine operation, and rock cutting are discussed. Improvements in designing cutters and developing cooled cutters are described. The machine steering system and a helium laser directional guide held horizontal and vertical deviations within 4 cm over 800 m. A scraper conveyor system was modified to successfully leave a clean floor while working in ground water. Comparing mechanical with conventional tunneling indicated that rock excavation costs are approximately equal. Problems of what is hard rock in regard to tunneling machines, rock properties for evaluation of rock cutting, and wear of cutters are covered. (USBR)
W69-08873

10. SCIENTIFIC AND TECHNICAL INFORMATION

BIBLIOGRAPHY OF REMOTE SENSING OF EARTH RESOURCES FOR HYDROLOGICAL APPLICATIONS,
Geological Survey, Washington, D.C. Water Resources Div.
For primary bibliographic entry see Field 07B
W69-08902

GLOSSARY OF TERMS USED IN FLUVIAL, DELTAIC, AND COASTAL MORPHOLOGY AND PROCESSES.
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 02J.
W69-08940

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W69-08718 08A

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W69-08740 02E

RECESSION OF PERMAFROST IN A CULTIVATED SOIL OF INTERIOR
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W69-08936 02G

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W69-08943 02B

FORMATION AND REDUCTION OF ICE FOG,
W69-08961 02B

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As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.

- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the FWPCA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

In cooperation with the Federal Water Pollution Control Administration, the following "centers of competence" have been established:

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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01 NATURE OF WATER
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02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
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04 WATER QUANTITY MANAGEMENT AND CONTROL
Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Non-Water Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION
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06 WATER RESOURCES PLANNING
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07 RESOURCES DATA
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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

A. General

YDROLOGIC CYCLE OF NORTH AMERICA ORMULATED BY THE ANALYSIS OF ATER VAPOR TRANSPORT DATA,
onnecticut Univ., Storrs.
urbachan P. Malhotra.
D Diss, Conn Univ, 1969. 159 p, 79 fig, 16 tab, ref, 1 append.

escriptors: *Hydrologic budget, *Hydrologic cy-e, *Climatology, *Synoptic analysis, Water por, Precipitation (Atmospheric), Evapotrans-ration, Runoff, Infiltration, Meteorology, eather, Atmosphere, Atmospheric physics, Dis-bution patterns, Weather patterns.
entifiers: North America, Water vapor transport, ux divergence.

he atmospheric water vapor flux divergence is ed to investigate the water balance of parts of orth America for the period May 1, 1958 to Apr. , 1963. Data include mean monthly vertically in-grated distribution of flux divergence and ecipitable water, regional averages of runoff, and hyetal averages of precipitation. The atmospher-data extend up to a height of 300 mb. The flux vergence and precipitable water were used to timate the mean difference between precipitation d evapotranspiration. The total area of study is out 8.5 million km (3.3 million sq mi). The pat-rn of monthly evapotranspiration and storage mputed from atmospheric data becomes estionable in areas smaller than 200,000 sq mi. is is due to systematic error, to the inadequacy of porting, or the density of stations. The ornthwaite method systematically gives higher lues of the Summer evapotranspiration, lower lues for Winter, lower values for storage in Fall, d higher values for storage in Spring, than vapor ux methods. Only the 12-month harmonic is sig-ficant at the 95% level. Generative processes for rious types of data have been identified and coef-ients worked out for formulating the models for ese processes in particular cases. (Knapp-USGS)
69-09154

FFECT OF KARST ON THE MINIMAL RU-OFF OF THE PLAINS RIVERS (RUSSIAN),
ate Hydrological Inst., Leningrad (USSR).
r primary bibliographic entry see Field 02E.
69-09168

INIMAL RUNOFFS OF TRANSBAIKALIAN IVERS (RUSSIAN),
ate Hydrological Inst., Leningrad (USSR).
r primary bibliographic entry see Field 02E.
69-09169

LECTRONIC MODELING METHOD OF CAL-ULATING STORMFLOW IN STEPPE AND OREST-STEPPE AREAS OF EUROPEAN USSR USSIAN),
ate Hydrological Inst., Leningrad (USSR).
A. Shiklomanov.
udy Gos Gidrol Inst, Issue No 163, p 126-148, 968. 23 p, 8 fig, 7 tab, 22 ref.

escriptors: *Floods, *Storm runoff, *Forest soils, Grasslands, *Electronics, *Mathematical models, ecipitation (Atmospheric), Hydrographs, reamflow, Hydraulic structures, High water ark, Slopes, Water loss, Infiltration, Evaporation.
entifiers: *USSR, Ukraine (European), Rain-orms.

n the basis of 4 gaging stations in the Ukraine, the drographs of rainstorm floods in small drainage eas were analyzed by using an electronic model-g apparatus. The analysis consisted of the calcu-ions of maximum discharges of percent frequen- using the Duhamel integral and experimental rmulas developed by I. A. Shiklomanov (1966), M. Kleen and R. Andrews (1962), Z. P. Bogomazova et al. (1948), D. L. Soklovskiy (1959), and others. The use of electronic modeling for the computation of floods of small unstudied streamflows is considered to be entirely reliable. (Gabriel-USGS)
W69-09170

MEAN LONG-TERM WATER BALANCE OF MOUNTAIN WATERSHEDS BASED ON THE DATA OF TRANSCARPATHIAN GAGING STATIONS (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W69-09171

NORMAL ANNUAL PRECIPITATION IN THE WESTERN SIBERIAN PLAIN AND NORTHERN KAZAKHSTAN (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02B.
W69-09172

THE HYDROMETEROLOGICAL INTERPRETATION OF THE PRECIPITATION PATTERN,
Meteorologischer Dienst der Deutschen Demokratischen Republic, Berlin. Forschungsinstitut fuer Hydrometeorologie.
For primary bibliographic entry see Field 02B.
W69-09176

METHODOLOGY OF HYDROLOGIC MODEL BUILDING,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 07C.
W69-09182

RAINFALL-RUNOFF MODEL FOR SMALL BASIN FLOOD HYDROGRAPH SIMULATION,
Geological Survey, Menlo Park, Calif.
R. W. Lichty, D. R. Dawdy, and J. M. Bergmann.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol Publ No 81, p 356-367, 1968. 12 p, 6 fig, 2 tab, 10 ref.

Descriptors: *Model studies, *Rainfall-runoff relationships, *Flood forecasting, *Mathematical models, Systems analysis, Digital computers, Computer programs, Streamflow forecasting, Parametric hydrology, Hydrograph analysis, Infiltration, Surface-groundwater relationships, Simulation analysis, Optimization.
Identifiers: *Rainfall-runoff models.

A simplified, mathematical model of the surface-runoff component of streamflow response to storm rainfall was developed and programmed for digital-computer solution. The model uses an infiltration component based on an equation by Philip to determine rainfall excess, which is transformed by a linear basin-response function to simulate the flood hydrograph. An objective-fitting procedure that emphasizes the simulation of peak-discharge rate was used to identify optimum model parameters in a pilot study of a 5-sq mi drainage basin in North Carolina. Split-sample fitting and testing showed that predictive capability varied for 3 samples of flood events. Results of simulation for 2 test samples of pre-1948 flood events showed reasonable correspondence between simulated and observed flood peaks. The post-1948 test sample showed wide scatter between simulated and observed flood peaks. The post-1948 test sample showed wide scatter between simulated and observed flood peaks. Sensitivity analysis of objective-function response to parameter incrementation showed that antecedent moisture accounting grossly controlled the results of optimization. (Knapp-USGS)
W69-09183

ADAPTION OF ELECTRONIC COMPUTER FOR IMPROVED METHOD OF MODELING SURFACE RUNOFF FROM RAINFALL FOR SMALL WATERSHEDS,
Utah Water Research Lab., Logan. Dept. of Civil Engineering.
For primary bibliographic entry see Field 07C.
W69-09186

GROUNDWATER-STREAMFLOW SYSTEMS IN WILSON CREEK EXPERIMENTAL WATERSHED, MANITOBA,
Manitoba Univ., Winnipeg. Dept. of Civil Engineering; and Manitoba Univ., Winnipeg. Dept. of Earth Sciences.
R. W. Newbury, J. A. Cherry, and R. A. Cox.
Can J Earth Sci, Vol 6, No 4, Part 1, p 613-623, Aug 1969. 11 p, 11 fig, 11 ref.

Descriptors: *Surface-groundwater relationships, *Streamflow, *Groundwater movement, *Water chemistry, Water quality, Hydrographs, Rainfall-runoff relationships, Infiltration, Runoff, Overland flow, Hydrologic budget, Base flow, Climates, Topography, Demonstration watersheds.
Identifiers: *Canada, *Manitoba, Wilson Creek Experimental watershed, Geochemical hydrographs.

Preliminary studies of the groundwater-streamflow systems in the Wilson Creek Watershed in southwestern Manitoba indicate that the hydrochemical characteristics of the system may be used to identify the base flow component of storm runoff hydrographs and to determine the proportions of the base flow derived from in-basin and out-of-basin recharge areas. Groundwater flow was studied by using a network of piezometers. Flow net analysis indicated local recharge and subsurface outflow from the basin. Base flow contributes sulfate, bicarbonate, and calcium to stream water. Streams, springs, and surface waters were analyzed and the results are shown by chemical hydrographs. (Knapp-USGS)
W69-09237

EVALUATION OF DROUGHT PERIODS BY COMPUTER ANALYSIS: AN APPLICATION IN SOUTHERN ITALY,
State Hydrographic Service, Genoa (Italy); and Rari Univ. (Italy).
For primary bibliographic entry see Field 07C.
W69-09275

MODELLING OF HYDROLOGIC PROCESSES WITH THE AID OF ELECTRONIC COMPUTERS,
Hydrometeorological Centre, Moscow (USSR).
L. S. Kutchment, and V. I. Koren.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 616-624, 1968. 9 p, 2 fig, 11 ref.

Descriptors: *Computer models, *Runoff forecasting, *Rainfall-runoff relationships, Evaporation, Storage, Infiltration, Digital computers, Analog computers, Routing, Streamflow forecasting, Optimization.
Identifiers: Rainfall-runoff models, Hybrid computers.

The development of mathematical models for runoff forecasting is discussed. The models include rainfall, infiltration, surface retention, evaporation, storage in catchment areas, and routing. Algorithms of the process may be solved on analog, digital, and hybrid computers. (Knapp-USGS)
W69-09277

2B. Precipitation

MANAGING CLIMATIC RESOURCES,
Rand Corp., Santa Monica, Calif.
J. O. Fletcher.

Prepared for publication in Impact, Jour of UNESCO. Rand Corporation, Publ P-4000-1, Mar 1969. 27 p, 3 fig, 18 ref.

Descriptors: *Thermal pollution, *Environmental effects, *Weather modification, *Computer simulation, *Atmospheric physics, Mathematical models, Weather data, Surface-water, Cloud cover, Heat exchange, Ocean circulation, Hydrologic cycle, Albedo, Carbon dioxide.
Identifiers: *Radiation balance, Ice extent, Global climate pattern, Satellite observation.

This report details the present knowledge and technology in observation, prediction and control of a human influence on the global climate by industrial heat discharge. Plans for both regional control of climatic variables and internationally cooperative projects are discussed for the future. Quantification of the global climate pattern involves data of ice extent, radiation variation, and atmospheric circulation. Variations of the patterns must be known (some meteorological history is given) before this data can be successfully used. Although it is concluded that the technological threshold from which progress can be proportional to the investment of effort has been reached, the following considerations are included: Current understanding of atmospheric and oceanic dynamics and heat exchange is too imperfect to predict the outcome of man's efforts to influence thermal forcing in atmospheric circulation. Although it would be theoretically more efficient to act directly on the moving atmosphere, engineering techniques for doing so are not presently available. The diversity of thermal processes that can be influenced in the atmosphere, and between the atmosphere and ocean, offers promise that, if global climate is adequately understood, it can be influenced for the purpose of either maximizing climatic resources or avoiding unwanted changes. (Sherman-Vanderbilt)
W69-09033

DISTRIBUTION OF HEAVY RAINFALL FREQUENCY AND ITS SEASONAL TRANSITION IN TOHOKU DISTRICT,
Tohoku Univ., Sendai (Japan). Faculty of Science.
Koya Hosokawa.
Sci Rep of Tohoku Univ, 7th Ser (Geogr), Vol 18, No 2, p 203-212, Mar 1969. 10 p, 4 fig, 6 ref.

Descriptors: *Rainfall intensity, *Frequency analysis, *Seasonal, Precipitation (Atmospheric), Water shortage, Flooding, Statistical methods, Typhoons, Topography, Summer, Winter, Spring, Climatology, Dynamics.
Identifiers: *Japan, Rainfall frequency.

Heavy rainfall frequency in the Tohoku district of Japan was investigated on the basis of field hydrologic mapping conducted by the author, and by earlier publications. The distribution of frequency varies with the season and can be subdivided into 4 distribution patterns, (February-June, July-August, September-November, and December-January). Seasonal transitions in the Tohoku district and Western Japan are a single microclimatic phenomenon. High frequency areas do not always coincide with the rainy areas, and in February the frequency of heavy snowfalls is high in the Pacific Ocean coastal area usually characterized by small snowfall. (Gabriel-USGS)
W69-09149

HYDROLOGIC CYCLE OF NORTH AMERICA FORMULATED BY THE ANALYSIS OF WATER VAPOR TRANSPORT DATA,
Connecticut Univ., Storrs.
For primary bibliographic entry see Field 02A.
W69-09154

NORMAL ANNUAL PRECIPITATION IN THE WESTERN SIBERIAN PLAIN AND NORTHERN KAZAKHSTAN (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
G. A. Plitkin.
Trudy Gos Gidrol Inst, Issue No 163, p 91-103, 1968. 13 p, 1 fig, 2 tab, 26 ref.

Descriptors: *Precipitation (Atmospheric), *Water balance, Hydrologic data, Meteorological data, Mapping, Rain gages, Evaporation, Gaging stations, Mathematical studies, Statistical methods, Rivers, Watersheds (Basins), Heat balance, Winds.
Identifiers: *USSR, *Siberia (Western), Northern Kazakhstan.

This article describes briefly the earlier publications devoted to the distribution of annual precipitations in the western Siberian plain and northern Kazakhstan, and discusses the reliability of methods used for the evaluation of this distribution. After computing the corrected annual precipitation records in western Siberia and Karakhstan and comparing the water balance and heat balance techniques, the author draws the following conclusions: (1) the normal annual precipitation can be evaluated as the sum of a normal runoff and evaporation in the areas characterized by excessive humidity and paucity of hydrologic and meteorologic observations, with the sum of evaporation and runoff computed after M. I. Budyko's formula; and (2) the normal annual precipitation in the Yamalo-Nenets National district, computed by using the Budyko formula, gave reliable results. (Gabriel-USGS)
W69-09172

THE RAINFALL MEASUREMENT PROBLEM,
Hydrological Research Unit, Wallingford (England).
For primary bibliographic entry see Field 07A.
W69-09175

THE HYDROMETEROLOGICAL INTERPRETATION OF THE PRECIPITATION PATTERN,
Meteorologischer Dienst der Deutschen Demokratischen Republic, Berlin. Forschungsinstitut fuer Hydrometeorologie.
H. Schubert.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 232-236, 1968. 5 p, 2 fig, 7 ref.

Descriptors: *Rainfall-runoff relationships, *Rainfall disposition, Networks, Rain gages, Distribution patterns, Isohyets, Hydrologic data, Water yield.
Identifiers: IHD, Rainfall microstructure.

The presentation of the precipitation pattern by meteorological criteria does not truly correspond to the hydrographic structure, this being the primary reason for the differences between the water budget developed from meteorological data and from balancing the water yield. Hence, a method was developed which restricts any subjective judgment of the data required for the preparation of the respective precipitation maps and permits a cartographic presentation of the optimum approximation of the precipitation pattern. A microstructure of the average precipitation pattern may be calculated from isohyetal maps, which is in reasonable agreement with the development of the hydrological network as well as with hydrological estimates by yield balance. (Knapp-USGS)
W69-09176

SYNTHESIS OF SEQUENCES OF SUMMER THUNDERSTORMS VOLUMES FOR THE ATTERBURY WATERSHED IN THE TUCSON AREA,
Arizona Univ., Tucson. Office of Hydrology and Water Resources.
A. Sariahmed, and C. C. Kisiel.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 439-447, 1968. 9 p, 2 fig, 5 tab, 12 ref. OWRR Proj A-010-ARIZ.

Descriptors: *Weather forecasting, * derstorms, *Arizona, *Mathematical m *Computer models, Digital computers, Simu analysis, Weather data, Flood forecasting, Ra runoff relationships, Operations research, Sy analysis, Synthetic hydrology, Depth-area-du analysis.
Identifiers: Tucson (Ariz).

An attempt is made to represent summer derstorm occurrences in the Tucson area some simple probabilistic principles and a computer. The purpose of the model is to fo many of the characteristics of the summer derstorms (storm duration, time between s storm depth, daily totals, etc). Such a simu model is intended as an input to a watershed for flood forecasting. Development of the m part of an operations research study of the hy gy and water resources of the Tucson basi synthetic data exhibits many of the characte of the historical sequences. However, the c tion between storm depth and storm dura weaker for the synthetic data than for its his counterpart. The model conserves the mea fall (seasonal, monthly, daily totals). (K USGS)
W69-09190

APPRAISAL OF RESEARCH ON WEA AND CLIMATE OF DESERT ENVIRONME
Arizona Univ., Tucson; and Army Natick Mass.
Clayton H. Reitan, and Christine R. Green.
IN W. G. McGinnies, B. J. Goldman, and P Paylore, eds., Deserts of the World, an Appra Research into their Physical and Biologic vironments, p 19-92, University of Arizona Tucson, 1968. 74 p, 3 tab, 482 ref.

Descriptors: *Deserts, *Arid climates, *Sy analysis, Arid lands, Semi-arid climates, Air lation, Climatic data, Microclimat Evapotranspiration, Evaporation, Weather n cation, Dust storms, Cloud bursts, Dew, Precipitation (Atmospheric), Thunders Weather patterns, Cloud cover, Weather Bibliographies, Winds, Irrigation effects, Sl belts, Solar radiation, Climatic zones.
Identifiers: Australian Deserts, Monte-Pata Desert, Atacama-Peruvian Desert, Kalahari-I Desert, Sahara Desert, Somali-Chalb D Arabian Desert, Iranian Desert, Thar Desert kestan Desert, Takla-Makan Desert, Gobi D North American Deserts.

This paper is a survey of what is known abo weather and climate of the deserts of the wor an evaluation of research needs. Climatic bri presented for the major world deserts. The clude major references for climatic data a synoptic climatology. Desert storms and up circulations are each discussed. The conc aridity is considered in relation to theoretic empirical measurements of water use, oasis potential evapotranspiration, classification mate, indexes or aridity, and climatic a Other topics treated are weather modific microclimate, radiation, bibliographies and d tories. The lack of a satisfactory system for mining water need and water use, and f pressing aridity in those terms is emphasize empirical equations of Penman and Budyk suggested to be the most practical methods mating water need. If aridity and quantitativ mates of water need are to be defined and mined in terms of these equations, ord unavailable climatological data such as rad measurements, cloud cover and vapor pressu be required. More field studies are needed to mine the variations of climate that occur mirco- and meso-scale of distance. The level rent research and the authorities are discuss each desert region of the world. (See W69-0 (Sherbrooke-Ariz)
W69-09207

ETEOROLOGICAL EXPERIMENTS FOR AU-OMATED SATELLITES,
ational Aernautics and Space Administration, ashington, D.C. Dept. of Meteorology and undings.
or primary bibliographic entry see Field 07B.
69-09242

UNS OF PRECIPITATION SERIES,
olorado State Univ., Fort Collins. Dept. of Civil ngineering; and Colorado State Univ., Fort Col-s. Dept. of Mathematics and Statistics.
or primary bibliographic entry see Field 07B.
69-09250

C. Snow, Ice, and Frost

OIL WATER MOVEMENT AS AFFECTED BY EEP FREEZING,
orest Service (USDA), St. Paul, Minn. North entral Forest Experiment Station.
or primary bibliographic entry see Field 02G.
69-09139

ATELLITE APPLICATIONS TO SNOW YDROLOGY, 1968,
nvironmental Science Services Administration, ockville, Md.
or primary bibliographic entry see Field 07B.
69-09178

D. Evaporation and Transpiration

YDROLOGIC CYCLE OF NORTH AMERICA ORMULATED BY THE ANALYSIS OF ATER VAPOR TRANSPORT DATA,
onnecticut Univ., Storrs.
or primary bibliographic entry see Field 02A.
69-09154

OMPUTER SIMULATION OF REMOTE ENSING BY MICROWAVE RADIOMETERS,
yan Aeronautical Co., San Diego, Calif.
or primary bibliographic entry see Field 07C.
69-09194

LTERING THE WATER BALANCE OF THE ASPIAN SEA BY REDUCING THE EVAPORA-ION AREA,
strakhan Hydrometeorological Observatory JSSR).
e. M. Kopaygorodskiy.
ceanology, Vol 7, No 1, p 91-93, 1967. 3 p, 2 fig. rans by Amer Geophysical Union from Oke-nologiya, Akad Nauk, SSSR, Vol 7, No 1.

escriptors: *Water balance, *Sea level, Evapora-on, Surface runoff, Precipitation (Atmospheric), roundwater movement, Dam construction, Sur-ce water, Groundwater.
lentifiers: USSR, *Caspian Sea, *Sea level sta-ilization.

he maintaining of a constant level of the Caspian ea is important for the national economy of the oviet Union. It was calculated that a 2-m fall in the :a level produced a 29,000 sq km reduction of the orth Caspian Sea. The water balance of the sea as used for calculation of the sea level stabiliza-on. The water balance requires the knowldege of ie following factors: surface runoff, groundwater ow, amount of precipitation on the sea, evapora-on from the sea surface, discharge into the Kara ogaz Gol, the fall in the sea level. The water alance equation was solved and it showed an an-ual deficit of 682 mm. Therefore, the Caspian Sea ould receive this amount annually in order to aintain a constant level. The dam construction nd other engineering structures were proposed to hange the hydrologic regime of the sea. (Carstea-SGS)
69-09202

CO sub 2 - GAS EXCHANGE AND WATER RELATIONS OF PLANTS IN THE NEGEV DESERT AT THE END OF THE DRY PERIOD,
Hebres Univ., Jerusalem (Israel).
For primary bibliographic entry see Field 02I.
W69-09204

THE EFFECT OF THE ADDITION OF HEAT FROM A POWERPLANT ON THE THERMAL STRUCTURE AND EVAPORATION OF LAKE COLORADO CITY, TEXAS, (STUDIES OF EVAPORATION),
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05C.
W69-09320

2E. Streamflow and Runoff

THE FLORENCE FLOODS,
Vermont Univ., Burlington. Dept. of Botany.
Richard M. Klein.
Natur Hist, Vol 78, No 7, p 46-54, Aug-Sept 1969. 1 fig, 4 photo.

Descriptors: *Floods, *Rainfall-runoff relationships, Streamflow, Discharge (Water), Disasters, Watershed management, Flood control, Flood protection, River training, Politcal aspects, Economics.
Identifiers: *Florence (Italy), Arno River.

The recent floods in Florence, Italy are not unique. The city has a long history of flood disasters caused by improper agricultural development of the Arno watershed in Tuscany, together with total law of flood control of the river. Of the 25-40 inches of rain every year in Tuscany, over 80% falls between October and January. The Tuscan hills have almost no vegetation except olives and grapes, no ground cover to retard runoff, and a nearly impervious soil surface. Since 1333 there has been a moderate flood every 24 years, a major flood every 26 years, and a disastrous flood every 100 years. The city's plan is ideal for intensifying flood damage, with its squares which fill rapidly and empty slowly, and a general layout that impedes runoff. No flood control, flood protection, or river training has ever been attempted. (Knapp-USGS)
W69-09132

CONJUNCTIVE USE OF GROUND AND SURFACE WATERS,
California State Dept. of Water Resources, Los Angeles.
For primary bibliographic entry see Field 04B.
W69-09136

FLOODS ON LICKING RIVER IN VICINITY OF SALYERSVILLE, KENTUCKY,
Geological Survey, Washington, D.C.
Curtis H. Hannum.
Geol Surv Hydrol Invest Atlas HA-329, 1 sheet, 1969. Text, 6 fig, 1 map, 2 photo, 1 tab, 2 ref.

Descriptors: *Floods, *Kentucky, *Stage-discharge relations, Discharge (Water), Streamflow, Surface waters, Hydrologic data, Flood control, Non-structural alternatives.
Identifiers: *Salyersville (Ky), Licking River.

A 1-sheet hydrologic atlas presents data that can be used to evaluate the extent, depth, and frequency of floods that affect the economic development of flood plains of the Licking River near Salyersville, Kentucky. The data provide a basis for solving existing flood plain problems and formulating regulations for land use and development that will reduce future flood damage. The report will be useful for preparing building and zoning regulations, locating waste disposal and water treatment facilities, and developing recreational areas. The flooded areas of 5, 25, and 50 year floods are shown on a 1:12,000 topographic map. Photographs, cross sections, profiles, text, and recurrence charts describe the flooding. (Knapp-USGS)
W69-09153

PEBBLE ORIENTATION IN A RECENT GRAVEL CHANNEL,
Akademiya Nauk SSSR. Sibirskoe Otdelenie. Institut Geologii i Geofiziki.
For primary bibliographic entry see Field 02J.
W69-09163

PROPAGATION OF THE FLOWS DISCHARGED BY THE 'GHEORGHE GHEORGHIU-DEJ' HYDROELECTRIC PLANT IN THE ARGES RIVER BED (ROMANIAN),
Institute of Hydrotechnical Research, Bucharest (Rumania).
For primary bibliographic entry see Field 04A.
W69-09166

EFFECT OF KARST ON THE MINIMAL RUNOFF OF THE PLAINS RIVERS (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
O. L. Markova.
Trudy Gos Gidrol Inst, Issue No 163, p 30-40, 1968. 11 p, 5 fig, 3 tab, 18 ref.

Descriptors: *Runoff, *Rivers, *Karst, River basins, Low water mark, Water circulation, Streamflow, Water control, Watersheds (Basins), Hydrologic data, Hydrogeology, Groundwater movement, Seasonal, Limestones, Dolomite, Geologic mapping, Structural geology.
Identifiers: *USSR, River runoff.

Minimal runoffs of rivers in karstic areas were analyzed on the basis of hydrogeological and meteorological data recorded in the Onega-Severnaya Dvina, Silurian plateau, Northern Volga, and Cisuralian regions. The karstic areas are important factors affecting the minimal runoffs; the effects of karstic areas are determined by a degree of their karstification and hydrogeologic characteristics. The effect of karst is manifested by a decrease in small stream runoffs and by an increase in groundwater runoff. Mean minimal 30-day drainage of karstic rivers draining groundwaters is considerably higher, 2 to 4 times, than that shown by zonal values. Karstic rivers draining groundwater reservoirs are characterized by consistency in maintaining their minimal runoffs. The evaluation of minimal runoff in karstic areas is difficult because the runoff is affected by several conditions which are difficult to evaluate. (Gabriel-USGS)
W69-09168

MINIMAL RUNOFFS OF TRANSBAIKALIAN RIVERS (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
Z. I. Peterson.
Trudy Gos Gidrol Inst, Issue No 163, p 41-54, 1968. 14 p, 6 fig, 2 tab, 5 ref.

Descriptors: *Runoff, *Rivers, *Discharge (Water), Mining, Water utilization, Gaging stations, Hydrogeology, Geologic mapping, Winter, Summer, Watersheds (Basins), Aquifers, Floods, High water mark, Water sources, Hydrographs, Precipitation (Atmospheric), Fissures (Geology), Winds.
Identifiers: *USSR, Amur River, Lena River, Yenisey River.

Minimal runoffs in the upper reaches of the Yenisey, Lena, and Amur River basins were analyzed on the basis of hydrogeological and meteorological data recorded during the 1959-1965 period. Using maps of distribution of minimal 30-day and annual water discharges and the tables of basic parameters of minimal runoffs, the Transbaikal region can be subdivided into 6 districts characterized by their distributions of annual precipitation and river discharges. (Gabriel-USGS)
W69-09169

ELECTRONIC MODELING METHOD OF CALCULATING STORMFLOW IN STEPPE AND FOREST-STEPPE AREAS OF EUROPEAN USSR (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02A.

W69-09170

MEAN LONG-TERM WATER BALANCE OF MOUNTAIN WATERSHEDS BASED ON THE DATA OF TRANSCARPATHIAN GAGING STATIONS (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
M. I. Kirilyuk.
Trudy Gos Gidrol Inst, Issue No 163, p 55-90, 1968. 36 p, 3 fig, 12 tab, 25 ref.

Descriptors: *Water balance, *Watersheds (Basins), *Discharge (Water), *Gaging stations, Agricultural watersheds, Streamflow, Geologic control, Soils, Forests, Precipitation (Atmospheric), Climates, Evaporation, Mathematical studies, Aquifers, Snow.
Identifiers: *USSR, Transcarpathian river basins.

An analysis is made of the effect of various basic parameters on the long-term water balance of the Rika River basin of Transcarpathia. Data recorded at 441 to 1431 m altitudes in 1947 to 1966 show that the monthly and annual precipitations are a function of altitude of the watersheds. The evaporation values for the basin were evaluated by using an equation of heat balance based on the actinometric observations recorded at the Mezhgor'ye gaging station. Changes in the supply of moisture in the snow cover, soils, and groundwater reservoirs were analyzed by using the corresponding data. Precipitation and runoff increase and the evaporation does not change with the watershed altitude. (Gabriel-USGS)
W69-09171

INVESTIGATIONS OF UNSTEADY WATER FLOW AND RIDGE-LIKE SEDIMENT DISPLACEMENT (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
M. S. Grushevskiy, A. A. Ivanova, V. A. Erikson, L. I. Rozenberg, and M. I. Rusinov.
Trudy Gos Gidrol Inst, Issue No 161, 1968. 128 p, 33 fig, 13 tab, 144 ref.

Descriptors: *Unsteady flow, *Streamflow, *Sediment transport, Hydrologic data, Analysis, Discharge (Water), Runoff, Waves (Water), Backwater, River beds, Tsunamis, Water transfer, Hydroelectric.
Identifiers: *USSR, Stream sediment transfer.

This monograph of 128 pages represents 8 investigations on unsteady water flow and sediment transport based on the analytical and experimental studies of data recorded in the USSR. The collection consists of the following articles: (1) Complex investigations of the unsteady flow in revers, as conducted by the State Geological Institute; (2) Analysis of natural data pertaining to the measurements of water discharges and hydraulic resistance under conditions of unsteady flow; (3) Investigation of water waves in the lower reaches of the Ivan'kovsk hydroelectric station; (4) Some peculiarities in computing unstable water flows under the conditions of backwash; (5) Approximate dependence of the velocity of propagation in a prismatic river channel with a flood plain (6) One-dimensional model for the calculation of unsteady water flows in rivers characterized by complex flood plains; (7) Study of the transformation of the Tsunamis long waves, using the Kamchatka Bay space model; and (8) Study of ridgelike displacement of the river Polometi sediments. (Gabriel-USGS)
W69-09173

REGIME, THEORY, AND CALCULATION AND MEASUREMENT METHODS OF SEDIMENTATION AND WATER RUNOFF (RUSSIAN),
V. M. Makkaveyev, K. V. Razumikhina, I. V. Bogolubova, V. V. Romanovskiy, and N. M. Kapitonov.
Trudy Gos Gidrol Inst, Issue No 156, 1968. 178 p, 33 fig, 45 tab, 133 ref.

Descriptors: *Sediments, *Runoff, *Mathematical studies, *Methodology, Streamflow, Turbulent flow, Rivers, Kinetics, Suspended load, Photography, Physical properties, Geographical regions, River basins, Irrigated land, Waves (Water), Wind velocity.
Identifiers: *USSR, Regime theory, Sedimentation theory and measurement, Water runoff theory and measurement.

This book is a collection of 12 investigations on the regime, theory, and calculation and measurement of sediments and water runoff based on analytical and experimental studies using the data recorded in the USSR. The following articles describe the studies: (1) Kinetics of turbulent river flow and the effect of sediments; (2) Some experience in the theoretical study of suspended load discharge of flat area rivers; (3) Results of field investigations and the calculation of runoff-entailed sediments of the Mzymty River; (4) Photographic method of granulometric analysis of course sediments; (5) Determination of the mean long-term annual discharge of sediments by taking physico-geographical conditions into consideration; (6) Study of discharge sediments of the Polomet River basin; (7) Sediment discharges of the rivers of the maritime province; (8) Determination of the norms and cyclic oscillations of the discharge of suspended load; (9) Field investigations of the sediments of irrigated lands; (10) The basis of turbidity formulas in evaluating wave spectra; (11) Principles of wind current modeling and the formation of pollution in water reservoirs; and (12) Natural study of dilution of river runoff and verification of calculating methods. (Gabriel-USGS)
W69-09174

DETERMINATION OF MIXING LENGTHS IN DILUTION GAUGING,
Water Research Association, Medmenham (England).
A. Barsby.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 395-407, 1968. 13 p, 6 fig, 8 ref.

Descriptors: *Tracers, *Tracking techniques, *Discharge measurement, *Mixing, Diffusion, Dispersion, Dye releases, Discharge (Water), Streamflow, Stream gages, Streamflow forecasting.
Identifiers: Dilution gaging (Streamflow), England.

Dilution gaging of river discharge depends on the injected tracer becoming adequately mixed with the flow before sampling. However, as dispersion along a needlessly great mixing length is wasteful of time and tracer, it is important to determine the minimum length of mixing, by calculation from channel and flow parameters or observation of the dispersion of a preliminary injection. Constant rate injections were used in a series of 9 tests of discharges ranging from 0.05 to 5 cu m/sec. At several stations along each stream, mixing was observed by measuring the variation in concentration from bank to bank. By using logarithmic interpolation of observed mixing at each station, deduced lengths for 99% mixing were compared with results given by empirical formulae. The most satisfactory of these was Rimmar's, and a modification of his formula is suggested, permitting evaluation of mixing lengths from easily measured parameters. Sayre's equation for lateral dispersion in a finite channel was developed to provide a simple technique of extrapolating from a partial mixing length to the 99% mixing length. Accordingly, preliminary injection experiments can be conducted over a small fraction of the eventual mixing length. Generally, calculations from channel parameters seems preferable in small turbulent streams, where a conservative estimate would be tolerable; the preliminary injection method is recommended for larger rivers where accuracy of prediction justifies the additional work involved. (Knapp-USGS)
W69-09177

THE USE OF STATISTICAL METHODS I SHORT-RANGE FORECASTS,
Hydrometeorological Service of the U (Moscow).
N. S. Nechaeva, and V. M. Mukhin.
Symp on Use of Analog and Digital Compute Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int As Hydrol, Publ No 81, p 405-416, 1968. 12 p, 3 f tab, 6 ref.

Descriptors: *Statistical models, *Runoff fore ing, *Streamflow forecasting, Regression anal Digital computers, Computer programs, Gages
Identifiers: *USSR, Short-range stream forecasts, Principal component analysis.

The forecasting of river stages and discharge statistical methods in the USSR is discus Because several requirements for direct regres are often not met by collected data, careful s tion of gages is necessary. The method of prin components has the advantages of good simula of events and the stability of coefficients of li equations. The use of matrices greatly simpl computation by computers of by manual meth (Knapp-USGS)
W69-09187

PROBLEMS IN SIMULATING AND EVALU ING VARIOUS METHODS OF LINEAR FLO ROUTING USING A SMALL DIGITAL C PUTER,
University Coll., Cork (Ireland).
For primary bibliographic entry see Field 07C.
W69-09188

MAKING ANALYTICAL TOOLS IN WA RESOURCES MANAGEMENT USABLE,
TRW Systems Group, Redondo Beach, Calif.; San Bernardino Valley Municipal Water Dist Calif.
For primary bibliographic entry see Field 06A.
W69-09189

STUDY OF THE NUMERIC CALCULATI OF THE PROPAGATION OF FLO (FRENCH),
Laboratoire National d'Hydraulique, Ch (France).
M. A. Daubert.
Symp on Use of Analog and Digital Compute Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int As Hydrol, Publ No 81, p 456-472, 1968. 17 p, 1 1 tab.

Descriptors: *Flood forecasting, *Mathema models, *Digital computers, Model studies, R fall-runoff relationships, Runoff forecasting, R ing, Water management (Applied), Hydrogra Stage-discharge relations, Flood routing.
Identifiers: *France, Rhone River, Rhine River, plicit methods, Implicit methods.

Mathematical models are coming into increa use as a means of investigating unsteady river channel flow. Their potential scope is br described. The Saint-Venant equations gradually varying unsteady flow constitute a hy bolic quasilinear system. The can be integrate 2 basic numerical methods: explicit methods implicit methods. Each problem is represented hydraulic scheme allowing for the various rami tions and featuring all the weirs, flow inputs, c sectional changes, diversions and other sp points in the system. One or 2 conditions (hy graph or level chart) will be given upstream f each branch, and a stage-discharge relationshi a level record downstream from the model, als operating relationship for each singular point. initial conditions also require defining. They ca calculated for steady flow, but if the phenom is already developing at the point at which the culation starts, they have to be assumed; they usually of little importance, however, as the fects are no longer felt after a certain time. E ples of flood-routing studies mentioned are a s of the Rhine at Karlsruhe and of the Rhone a

ns. The Rhine's hydraulic scheme features a
ıber of hydro-power plants and that of the
ne several weirs. (Knapp-USGS)
9-09192

**E OF DIGITAL COMPUTERS IN INTERNA-
NAL WATER RESOURCES INVESTIGA-
NS,**
d and Agriculture Organization of the United
ions, Rome (Italy).
primary bibliographic entry see Field 07C.
9-09195

**OUNDWATER-STREAMFLOW SYSTEMS IN
LSON CREEK EXPERIMENTAL
TERSHED, MANITOBA,**
nitoba Univ., Winnipeg. Dept. of Civil En-
ering; and Manitoba Univ., Winnipeg. Dept. of
th Sciences.
primary bibliographic entry see Field 02A.
9-09237

**ME GUIDELINES FOR REMOTE SENSING
HYDROLOGY,**
ological Survey, Washington, D.C.
primary bibliographic entry see Field 07B.
9-09241

**TEOROLOGICAL EXPERIMENTS FOR AU-
MATED SATELLITES,**
ional Aernautics and Space Administration,
shington, D.C. Dept. of Meteorology and
ndings.
primary bibliographic entry see Field 07B.
9-09242

**OOD-FORECAST SYSTEM IN THE
KONG DELTA, CAMBODIA,**
mpagnie Nationale du Rhone, Lyon (France).
es Menard.
ture and Resources, Vol 5, No 2, p 2-4, June
9. 3 p.

scriptors: *Flood forecasting, *Mathematical
dels, *Deltas, *Routing, Water levels, Stream-
w, Rainfall-runoff relationships, Rainfall disposi-
n, Runoff forecasting, Floods.
ntifiers: *Cambodia, *Mekong Delta.

ods of the Mekong Delta, Cambodia are
ecasted by use of a mathematical model built to
delta geography and hydrology. The model is
o used to study the feasibility of flood control by
lding a gate dam on the Tonle Sap to control
er flow between the Mekong and the Great
ke. With proper calibration the model deter-
nes water levels throughout the Delta, and rout-
equations describe flood wave propagation for
entire area when rainfall distribution and water
els are known. (Knapp-USGS)
9-09245

**ECIAL FLOOD HAZARD INFORMATION,
OAL CREEK, JOPLIN, MISSOURI.**
rps of Engineers, Tulsa, Okla.
r primary bibliographic entry see Field 06F.
9-09259

**ATER RESOURCES DEVELOPMENT BY
E U.S. ARMY CORPS OF ENGINEERS IN
ORIDA.**
rps of Engineers, Atlanta, Ga. South Atlantic
r primary bibliographic entry see Field 04A.
9-09262

**ATER RESOURCES DEVELOPMENT BY
E U.S. ARMY OF ENGINEERS IN MIN-
SOTA.**
rps of Engineers, Chicago, Ill. North Central
r primary bibliographic entry see Field 04A.

W69-09263

GENERATION OF FITTING PROBABILITY DISTRIBUTION FUNCTIONS OF DISCHARGES BY ELECTRONIC COMPUTER,
Research Inst. for Water Resources Development, Budapest (Hungary); and Eotvos Lorand Univ., Budapest (Hungary). Dept. of Theory of Probability.
For primary bibliographic entry see Field 07C.
W69-09268

ON A PROBLEM OF FIXATION OF RESERVOIR CAPACITY SOLVED WITH THE HELP OF ELECTRONIC COMPUTER,
Central Water and Power Commission, New Delhi (India).
For primary bibliographic entry see Field 07C.
W69-09269

A DIMENSIONLESS REPRESENTATION OF FLOOD WAVE SUBSIDENCE BY MEANS OF A SUBSIDENCE FUNCTION,
Netherlands, Rijkswaterstaat.
J. W. Van der Made.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 569-583, 1968. 15 p, 11 fig, 1 tab, 2 ref.

Descriptors: *Floods, *Recession curves, *Computer programs, Flood plains, Flood forecasting, Streamflow forecasting, Stage-discharge relations, Routing, Hydrographs, Hydrograph analysis.
Identifiers: Forchheimers formula, Flood waves.

By applying Forchheimer's formula for flood wave crest subsidence in a discharge profile with partly or entirely inundated flood plains, a relation was developed between the subsidence of a unit runoff in a unit profile and the subsidence of a variable runoff in the profile considered. Numerical values of a 'subsidence function' were derived from a computer calculation. Observations of an actual situation fit reasonably the theoretical scheme. (Knapp-USGS)
W69-09272

ALTERNATIVE DIGITAL COMPUTER APPLICATIONS TO EVALUATE LINKED WATER RESOURCES,
Water Research Association, Medmenham (England).
For primary bibliographic entry see Field 07C.
W69-09273

SELF-SIMILAR SYNTHETIC HYDROLOGY,
IBM Watson Research Center, Yorktown Heights, N. Y.
For primary bibliographic entry see Field 07C.
W69-09280

FLOOD PLAIN INFORMATION, SOUTH FORK ZUMBRO RIVER AND TRIBUTARIES, ROCHESTER, MINNESOTA.
Corps of Engineers, St. Paul, Minn.
For primary bibliographic entry see Field 04A.
W69-09286

2F. Groundwater

APPLICATION OF DEEP ELECTRICAL SOUNDINGS FOR GROUNDWATER EXPLORATION IN HAWAII,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 07B.
W69-09133

CONJUNCTIVE USE OF GROUND AND SURFACE WATERS,
California State Dept. of Water Resources, Los Angeles.
For primary bibliographic entry see Field 04B.

W69-09136

SIMULTANEOUS FLUXES OF LIQUID AND CHARGE IN SATURATED KAOLINITE,
Geological Survey, Menlo Park, Calif.
Harold W. Olsen.
Soil Sci Soc Amer Proc, Vol 33, No 3, p 338-344, May-June 1969. 7 p, 9 fig, 2 tab, 8 ref.

Descriptors: *Saturated flow, *Clays, *Ion transport, *Electrolytes, *Thermodynamics, Kaolinite, Mass transfer, Darcy's law, Heat transfer, Diffusion.
Identifiers: *Irreversible thermodynamics.

Experimental data obtained on a liquid saturated sample of sodium kaolinite consolidated under 408 kg/sq cm, show that the simultaneous fluxes of liquid and charge under hydraulic, electrical, and electrolyte concentration gradients obey the macroscopic rate laws derived from the irreversible thermodynamics of discontinuous systems, except that the experimental flux versus driving force relations possess hydraulic and electrical potential intercepts. It is proposed that the intercepts arise from electrolyte concentration gradients within the sample, generated by differential salt filtering at the sample surfaces during consolidation increments. This mechanism is suggested by nonsymmetrical details in the mechanical system used to consolidate the sample, and it provides an explanation for the intercepts which is not inconsistent with the fundamental postulates of irreversible thermodynamics. (Knapp-USGS)
W69-09140

GROUND-WATER RESOURCES OF JOHNSON COUNTY, TEXAS,
Geological Survey, Austin, Tex.
Gerald L. Thompson.
Tex Water Develop Board Rep No 94, Apr 1969. 84 p, 17 fig, 8 tab, 38 ref.

Descriptors: *Water resources, *Groundwater, *Texas, Water wells, Water yield, Water quality, Aquifers, Water utilization, Hydrologic data, Data collections, Water levels, Water-level fluctuations.
Identifiers: *Johnson County (Tex).

About 3.2 mgd or 3,600 acre-ft annually, of groundwater was used in Johnson County Texas in 1966 for public supply (1.2 mgd), rural domestic (0.98 mgd), livestock (0.89 mgd), and industrial (0.17 mgd) needs. Part of the water for public supply and industrial uses in the central part of the county is surface water obtained from recently constructed reservoirs. The principal water-bearing formations in the county and the approximate quantity of water supplied in 1966 are, as follows: Hosston Formation, 580 acre-ft; Travis Peak Formation, 360 acre-ft; Paluxy Sand, 2,000 acre-ft; Woodbine Formation, 680 acre-ft; and a small quantity from the Quaternary alluvial deposits. About half of the water now being withdrawn from the Paluxy comes from storage; the Paluxy transmits about 1,000 acre-ft per yr (about 1 mgd) less than the quantity currently being pumped in the county. In 1966, pumpage from the Woodbine was less than half of the amount transmitted. Also, there is available from storage in the Woodbine in the eastern part of the county, about 2,100,000 acre-ft of water. (Knapp-USGS)
W69-09148

A POSSIBLE THERMAL SPRING DEPOSIT IN THE 'ARAD AREA, ISRAEL,
Geological Survey of Israel, Jerusalem.
For primary bibliographic entry see Field 02K.
W69-09158

A NOTE ON THE POSSIBLE ORIGIN OF THE SO-CALLED KARSTIC CAVES AT MA'ALE HAMESHAR IN THE CENTRAL NEGEV,
A. Issar, and Shulamit Gross.
Israel J Earth-Sci, Vol 18, No 1, p 29-32, 1969. 4 p, 5 fig, 9 ref.

Descriptors: *Karst, *Thermal water, Mineralogy, Groundwater movement, Solutes, Aqueous solution, Solubility, Thermal springs, Carbonate rocks, Water chemistry, Manganese.
Identifiers: *Israel, Negev.

Caves formed by solution processes are reported from the central Negev. The caves were assumed to have formed by karst-forming processes involving dissolution of rocks by meteoric water circulation. Further studies of this phenomenon revealed mineralization phenomena which make it difficult to attribute to the caves a normal karstic genesis and which indicate a process involving ascending mineralized water. (Knapp-USGS)
W69-09159

GROUND-WATER FLOW SYSTEMS AND THE ORIGIN OF EVAPORITE DEPOSITS,
Idaho Bureau of Mines and Geology, Moscow.
Roy E. Williams.
Idaho Bur Mines and Geol Pam No 141, Aug 1968. 15 p, 3 fig, 39 ref.

Descriptors: *Water chemistry, *Groundwater, *Saline water systems, Aqueous solutions, Groundwater movement, Porosity, Permeability, Solubility, Leaching, Solutes.
Identifiers: *Evaporites.

Study of the literature on evaporite mineral deposits suggests a functional relationship between the origin of these deposits and ground water flow systems. The theory on which the analysis of groundwater flow systems is based is reviewed in order to establish flow systems as a mechanism by which dissolved solids can be transported to sites of evaporite mineral accumulation. Comparison of observed spatial variations of groundwater quality with pertinent solutions to flow equations under specified boundary conditions reveals that quality of groundwater is a function of flow path length, flow path route and flow velocity. Selected references provide evidence that sites of accumulation of non-marine evaporite minerals are discharge zones for poor quality water from regional groundwater flow systems. A study of isotope rations in oil field brines and standard mean ocean water indicates that water in some deep brines is of local meteoric origin; therefore, the brines are part of a groundwater flow system. Observed distribution of fluid potential in the saline portion of some groundwater flow systems on the Atlantic Coast of the United States reveals that saline groundwater discharges toward the ocean floor. Therefore, groundwater may also act as a transport medium for dissolved solids which are precipitated, under appropriate conditions, as marine evaporite deposits. (Knapp-USGS)
W69-09160

EXPERIENCES GAINED WITH DIGITAL COMPUTERS IN ANALYZING THE DISCHARGE AND THE RADIUS OF INFLUENCE OF WELLS IN POROUS AQUIFERS,
Design Bureau for Hydraulic Planning, Budapest (Hungary).
S. Leczfalvy.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol Publ No 81, p 368-377, 1968. 10 p, 7 fig, 2 tab.

Descriptors: *Mathematical models, *Groundwater movement, *Digital computers, Steady flow, Unsteady flow, Water table, Discharge (Water), Aquifers, Drawdown, Drainage systems, Recharge, Infiltration, Seepage.
Identifiers: Hungary.

The relations of discharge and radius of influence to infiltration rates, hydraulic gradient, and regional water table in constant-drawdown wells and mine drains are studied. The derivation of descriptive formulae was aided by computers. Analysis of data showed that the radius of influence was greatly diminished with higher infiltration rates without increase of discharge. The greatest influence on discharge is exerted by permeability. Solutions of seepage and groundwater movement problems are presented for horizontal and tilted water tables replenished by precipitation, with both steady and non-steady flow. (Knapp-USGS)
W69-09184

SIMULATION OF THE HYDROLOGIC-ECONOMIC FLOW SYSTEM,
Utah Water Research Lab., Logan. Dept. of Civil Engineering.
For primary bibliographic entry see Field 07C.
W69-09185

ANALYTIC TECHNIQUES FOR DETERMINING GROUND WATER FLOW FIELDS,
California Univ., Berkeley. Hydraulic Engineering Lab.
Mohsen Shahbazi, and David K. Todd.
Calif Univ Water Resources Center Contrib No 117, Aug 1967. 139 p, 26 fig, 36 ref, 4 append.

Descriptors: *Groundwater movement, *Steady flow, *Model studies, *Groundwater basins, Infiltration, Discharge (Water), Recharge, Mathematical models, Hydraulic models, Flow nets, Synthetic hydrology, Water levels, Saturated flow.
Identifiers: *Hele-Shaw models.

Analytic techniques were developed and applied to the study of the flow pattern in a two-dimensional steady state, homogeneous isotropic groundwater basin. The geometry of the zones of recharge and discharge is a function of ground-surface profile, variation in rate of recharge, hydraulic conductivity of porous media, and the geometry of the flow domain. Two independent methods of solution, using least square and Fourier expansion, were developed to solve the Laplace equation for single-layered and multi-layered systems; the results were checked with laboratory experiments using the Hele-Shaw model. A mathematic model was formulated to accurately describe the flow pattern in a two-dimensional steady state groundwater basin. (Knapp-USGS)
W69-09196

METHODS AND TECHNIQUES OF GROUNDWATER INVESTIGATION AND DEVELOPMENT,
United Nations Educational, Scientific and Cultural Organization, New York; and Economic Committee for Asia and Far East.

United Nations Publication, Water Resources Ser No 33, 1967. 206 p, 79 fig, 25 tab.

Descriptors: *Groundwater, *Water resources development, *Water management (Applied), Surveys, Tracers, Hydrogeology, Model studies, Water storage, Systems analysis, Optimization, Economics.
Identifiers: ECAFE, Far Eastern Nations.

The proceedings of the 2nd seminar on methods and techniques of Groundwater Investigations consist of seminar discussions, lectures by consultants, and a collection of hydrological papers by conference participants. The topics presented in detail include field procedures, water resources evaluations, water storage, analog models, mathematical models, water resources management, hydrogeology, isotope investigations, and groundwater studies in the nations of the ECAFE Region. (Knapp-USGS)
W69-09197

THEORETICAL ANALYSIS OF GROUNDWATER BASIN OPERATIONS,
California Univ., Berkeley. Hydraulic Engineering Lab.
William D. McMillan.
Calif Univ Water Resources Center Contrib No 114, Nov 1966. 167 p, 17 fig, 20 tab, 117 ref, 3 append.

Descriptors: *Groundwater basins, *Model stud
*Statistical models, Mathematical models, Hydr
lic conductivity, Computer programs, Synth
hydrology, Groundwater movement, Permeabili
Identifiers: Richards equation, Basinwide mana
ment.

A statistical treatment was utilized to study
relative importance of basin-wide heterogeneit
operational analysis of groundwater bas
Richard's equation was solved for a range of co
tions to evaluate the difference in homogene
and heterogeneous conditions. The variances o
sumed randomly distributed conductivity va
and the resulting potential field displacements w
found to be closely related. Analysis of conduc
ty data from several sources indicated that cond
tivity values tended to follow a lognormal distri
tion. Frequency analyses of available field data
dicated that the conductivity logarithms were n
mally distributed with variance values in the ra
0.5 to 0.8. Digital computer programs w
developed and utilized to evaluate the relations
between the conductivity deviation and the res
ing variation in the potential field for 1, 2, an
dimensional flow-fields over a range of values
mean conductivity, mean potential gradient,
basin size and shape. A statistical evaluation of
relationship was obtained by means of repeti
numerical solutions using machine-generated r
dom conductivity samples with selected distri
tion parameters. (Knapp-USGS)
W69-09198

**FRESH-WATER SPRINGS OF HAWAII FR
INFRARED IMAGES,**
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07B.
W69-09199

**GENERAL REPORT ON THE GROUNDWAT
INVESTIGATION OF THE AZRAQ BASIN.**
United Nations Development, New York.

United Nations Develop Programme Rep, 1966
p, 15 fig, 5 map, 20 tab, 46 ref, append.

Descriptors: *Water resources, *Groundwa
*Groundwater basins, *Arid lands, United Natio
Surveys, Water wells, Water yield, Water qua
Recharge, Discharge (Water), Hydrologic d
Data collections, Water sources, Aquifers, Sprin
Identifiers: *Jordan, *Azraq Basin.

The Azraq Basin, Jordan, is a desert area of inte
drainage. Springs near the center support a sm
agricultural and salt-producing economy.
geologic formations exposed in the basin range
age from cretaceous to recent, and include s
mentary and volcanic rocks. Both types of ro
yield water to the springs in El-Azraq and to w
at scattered places in the basin. The wells tap b
artesian and unconfined groundwater, but spec
capacities and permeabilities generally are low
ploratory drilling and testing in the basin show t
aquifers in the deep-lying Kurnub sandstone ar
too great a depth to be economically exploited
water, and that the permeability of the formatio
low in the Azraq area. The overlying Ajlun Se
does not contain groundwater in significant qua
ties. The lower aquifers in the next overlying Be
Series of sedimentary rocks probably are at
great a depth to be exploited under pres
economic conditions. Withdrawal of groundw
from the aquifers at intermediate and shal
depths in the sedimentary and volcanic rock
feasible, but the perennial supply is limited
withdrawals of any magnitude will reduce
discharge of the springs at El-Azraq. Perenni
available water resources of the basin are
limited, and are being used at the optimum rate
that any additional large-scale development wo
upset the water-resources regimen and econom
the basin. Recharge was estimated to be about
of precipitation. Much of the groundwater i
marginal or unsuitable quality for irriga
because it has a high sodium and salinity haz
(Knapp-USGS)
W69-09200

HE INK POTS-A GROUP OF KARST SPRINGS N THE ROCKY MOUNTAINS NEAR BANFF, LBERTA,
epartment of Energy, Mines and Resources, Calary (Alberta). Inland Waters Branch.
. O. Van Everdingen.
an J Earth Sci, Vol 6, No 4, Part 1, p 545-554, ug 1969. 10 p, 8 fig, 2 tab, 5 ref.

escriptors: *Springs, *Karst, *Carbonate rocks, Rocky Mountain region, Currents (Water), ischarge (Water), Water quality, Water chemisy, Water circulation, Groundwater movement, echarge.
dentifiers: *Canada, Alberta, Banff.

he Ink Pots are a group of springs in Banff Naonal Park. The one feature that makes these prings of more than passing interest is the greenish ilky appearance of two of the ponds in the group. his difference in appearance of the water cannot e explained by dissolved or suspended chemicals, r by algae growth. It can be explained by diferences in flow velocity, which cause differential uspension of fine sand and silt. Temperature and hemical character of spring water from the Ink ots indicate, respectively, shallow circulation and relatively short 'contact' time. (Knapp-USGS)
V69-09236

ROUNDWATER-STREAMFLOW SYSTEMS IN VILSON CREEK EXPERIMENTAL VATERSHED, MANITOBA,
Manitoba Univ., Winnipeg. Dept. of Civil Engineering; and Manitoba Univ., Winnipeg. Dept. of Earth Sciences.
For primary bibliographic entry see Field 02A.
V69-09237

AIRBORNE REMOTE SENSING FOR GROUNDWATER STUDIES IN PRAIRIE ENVIRONMENT,
Department of Agriculture, Edmonton (Alberta). Water Resources Div.
For primary bibliographic entry see Field 07B.
W69-09239

THE IMPACT OF THE DEEP TUNNEL PLAN ON THE WATER RESOURCES OF NORTHEAST ILLINOIS.
Harza Engineering Co., Chicago, Ill.; and Bauer Engineering, Inc., Chicago, Ill.

Harza Eng Co and Bauer Eng, Inc Rep to Chicago Metrop Sanit Dist, Feb 1969. 20 p, 6 fig, 1 append.

Descriptors: *Water pollution control, *Storm runoff, *Tunnels, *Water storage, *Hydrologic aspects, Storm drains, Pumped storage, Retention, Groundwater, Aquifers, Illinois, Cities, Urbanization.
Identifiers: *Chicago deep tunnel plan, Combined sewers.

The possible effects of the proposed Chicago deep tunnel urban runoff retention scheme on the water resources of northeastern Illinois were estimated by surveying the hydrogeology, surface water hydrology, and groundwater development of the area. Chicago has a combined sewer system, and storm runoff overloads cause discharge of raw sewage to waterways including recreational areas of Lake Michigan. A system of deep tunnels and protective recharge wells is proposed for temporary storage of peak combined loads. The system is expected to release treated storm runoff at a steady rate, greatly regulating the streamflow of receiving streams. High groundwater heads must be maintained to prevent loss of contaminated water from the tunnels, requiring good groundwater management practices for the entire area. (Knapp-USGS)
W69-09261

DIGITAL COMPUTER APPLICATIONS THAT FACILITATE COLLECTION AND INTERPRETATION OF GROUNDWATER DATA,
Geological Survey, Lawrence, Kans.

For primary bibliographic entry see Field 07C.
W69-09271

HYBRID COMPUTER SIMULATION OF A LOW-FLOW AUGMENTATION SUBSURFACE STORAGE SYSTEM,
For primary bibliographic entry see Field 07C.
W69-09276

NUMERICAL SOLUTIONS OF THE NAVIER STOKES EQUATION FOR FLOW THROUGH IDEALIZED POROUS MATERIALS,
University Coll. of Townsville (Australia). Dept. of Engineering.
K. P. Stark.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 635-649, 1968. 15 p, 16 fig, 3 tab, 27 ref.

Descriptors: *Groundwater movement, *Mathematical studies, *Digital computers, Approximation method, Numerical analysis, Flow, Porous media, Equations.
Identifiers: Navier-Stokes equations, Heration methods.

Solutions of the Navier-Stokes equations for flow in porous media are possible with high-speed digital computers. The solutions can give detailed information about flow characteristics, and compare well with experimental results. Numerical methods discussed include linearization, finite difference techniques, boundary condition selection, and the use of limiting equations such as Darcy's. (Knapp-USGS)
W69-09278

APPLICATION OF STATISTIC METHODS FOR SOLUTION OF STEADY AND UNSTEADY GROUNDWATER FLOW,
For primary bibliographic entry see Field 07C.
W69-09279

GROUNDWATER PROBLEMS,
Swedish Natural Science Research Council, Stockholm.
E. Eriksson, Y. Gustafsson, and K. Nilsson.
Proc Int Symp on Groundwater Problems, Oct 1966, Stockholm, Sweden, Wenner-Gren Symp Ser, Vol 11, 1968. 223 p.

Descriptors: *Water resources, *Groundwater, *International hydrological decade, *Conferences, Groundwater movement, Hydrogeology, Aquifers, Water chemistry, Water quality, Water level fluctuations, Tracers, Water pollution, Artificial recharge, Water storage, Water yield.
Identifiers: *Sweden, Groundwater development, Symposium.

Groundwater problems in Sweden are discussed in a 12-paper IHD symposium held in 1966. In Sweden over half of all domestic water is developed from groundwater, and the amount is increasing. Groundwater depletion, land subsidence, and groundwater contamination exist and may become more serious. The symposium includes the general topics of groundwater movement, groundwater storage, water availability, water-level fluctuations, hydrogeology, groundwater chemistry, tracer studies, water quality protection, and artificial recharge. (See also W69-09283 and W69-09284). (Knapp-USGS)
W69-09282

GROUNDWATER IN PRECAMBRIAN ROCKS IN SOUTHERN SWEDEN,
Lund Univ. (Sweden). Dept. of Physical Geography.
Ingemar Larsson.
Proc Int Symp on Groundwater Problems, Oct 1966, Stockholm, Sweden, Wenner-Gren Symp Ser, Vol 11, p 23-41, 1968. 19 p, 21 fig, 16 ref.

Descriptors: *Groundwater, *Fractures (Geology), *Hydrogeology, Faults (Geology), Groundwater movement, Permeability, Porosity, Structural geology, Geologic control.
Identifiers: *Sweden.

Groundwater in Precambrian gneisses and granites in southern Sweden only in faults and joints in the rock. By fabric analysis it is possible to separate two main groups of these fractures: the local pattern, syntectonic to the fold axis, and the grain fabric and the post-crystalline pattern. Within certain limits the latter may be generalized to a tectonic model. The faults and joints of the local pattern produce a very low yield of groundwater. It is shown in the paper how some of the faults and joints of the postcrystalline pattern may give a high yield of groundwater, and their relation to the tectonic model is discussed. (See also W69-09282). (Knapp-USGS)
W69-09283

TRACERS FOR GROUNDWATER INVESTIGATIONS,
Chalmers Univ. of Technology, Goteborg (Sweden). Inst. of Geology.
Gert Knutsson.
Proc Int Symp on Groundwater Problems, Oct 1966, Stockholm, Sweden, Wenner-Gren Symp Ser, Vol 11, p 123-152, 1968. 30 p, 10 fig, 1 tab, 98 ref.

Descriptors: *Tracers, *Tracking techniques, *Groundwater movement, Aquifers, Radioisotopes, Salts, Ions, Electrolytes, Dye releases, Hydrogeology, Karst, Sands, Gravels.
Identifiers: Complex ion tracers.

Tracers have been used in Sweden since 1869 to establish hydraulic connections in the ground and to determine the velocity of groundwater flow. Some organic dyes, Sulforhodamine G Extra, Rhodamine WT and under certain pH conditions also Uranine, seem to be useful as tracers for investigating groundwater flow in fractures and channels. Cation tracers are mostly adsorbed in porous media. Tracers for studying groundwater flow must be chosen from among anions and metal complexes. Thanks to the rapid development of analytical methods (atomic absorption, emission spectrography and neutron activation analysis) it is possible today to perform tracer tests using low concentrations of anions and complexes. Selective and precise measurement of low concentration of the radioisotopes can usually be carried out directly in the field. Tritiated water is a good tracer as it behaves essentially the same as normal water. But tritium is not easily detected in the field because of its very soft beta radiation. Among anions, iodide ion (NaI or KI containing I-131 and bromide ion containing Br-82) seem to be the most reliable. A disadvantage is that their half-lives are too short for most groundwater tests. Two very stable metal complexes are cobalt-cyanide containing Co-60 or Co-58 and Cr-51 EDTA complex have more suitable half-lives and have been successfully applied in many field investigations. Stable isotopes and natural radioisotopes are of great importance to obtain a general survey of the regional groundwater conditions, to determine the geographical origin, the age of water and in studying the water balance. (See also W69-09282). (Knapp-USGS)
W69-09284

DISTRIBUTION OF MINERAL WATERS IN THE GERMAN DEMOCRATIC REPUBLIC (GERMAN),
Central Geological Inst., Berlin, (East Germany).
Johannes Zieschang.
Z Angew Geol, Vol 14, No 9, p 493-497, Sept 1968. 5 p, 1 fig, 18 ref.

Descriptors: *Groundwater, *Mineral water, Water chemistry, Sodium, Ions, Chlorine, Structural geology, Hydraulic properties, Mineralogy, Water districts, Mapping.
Identifiers: *German Democratic Republic, Mineral water distribution.

About 3/4 of the territory of the German Democratic Republic contains mineralized groundwaters containing mainly Na and Cl ions. A map shows various mineralized provinces of the G.D.R. on the basis of geological, hydrochemical, and hydrological studies. To a great extent the genesis of the mineral waters of these provinces can be derived from the evaluation of the various parameters characterizing each province. (Gabriel-USGS)
W69-09285

HYDROGEOLOGICAL STUDIES FOR DRINKING WATER SUPPLY OF CRAIOVA CITY (ROMANIAN),
For primary bibliographic entry see Field 04B.
W69-09287

STRUCTURE, STRATIGRAPHY, AND HYDROGEOLOGY OF THE NORTHERN ROSWELL ARTESIAN BASIN, CHAVES COUNTY, NEW MEXICO,
Kay C. Havenor.
N Mex Bur Mines and Mineral Resources, Inst of Mining and Technol Circ No 93, 1968. 30 p, 2 fig, 6 tab, 23 ref, 2 append.

Descriptors: *Hydrogeology, *Aquifers, *Artesian wells, *New Mexico, Porosity, Saline water intrusion, Water yield, Geology, Structural geology, Faults (Geology), Geologic control, Karst.
Identifiers: *Roswell Artesian Basin (N Mex).

Structural and stratigraphic controls of the quantity and quality of waters within the northernmost part of the Roswell artesian basin were studied using outcrops, cores, samples, and electric logs. Three structural blocks named Six Mile, Roswell, and Orchard Park, are delineated. The artesian aquifer is developed in the top 1.3 of the San Andres upperunit and in the overlying Grayburg. The Queen forms the aquitard between the artesian and shallow aquifer of the Seven Rivers Formation and the overlying Tertiary - Quarternary alluvium. Structural uplift and consequent deep, irregular erosion have stripped the Artesia Group and the upper unit of the San Andres from the Roswell block. Secondary porosity enlargement has been developed in the Slaughter zone of the artesian aquifer. Reduced heads, because of regional over-appropriation, and reduced pressure, caused by locally intensive pumping on the Roswell block, relieve the retarding hydrostatic pressure on the saline waters in the regionally porous Slaughter zone and permit saline water encroachment into the Roswell block. (Knapp-USGS)
W69-09290

SUBSIDENCE IN MEXICO CITY IN RELATION TO GROUNDWATER OVERDRAFT,
Office of Hydraulic Resources (Mexico).
Ignacio Sainz Ortiz.
Hydrol of Fractured Rocks Vol 2, Proc Dubrovnik Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74, p 665-671, 1967. 7 p, 6 fig.

Descriptors: *Mexico, *Subsidence, *Overdraft, *Groundwater, *Water resources, Topography, Economics, Population, Water storage, Water requirements, Water wells, Geology, Porosity, Pressure, Aquifers, Pumping, Water recharge.
Identifiers: Mexico City.

The author illustrates and briefly discusses the hydrologic, geologic, and hydraulic conditions which exist in the aquifers of the Mexico City area and suggests some methods for decreasing the process of subsidence. Several charts, cross sections, and curves are used to summarize the pumping and borehole data and to show that surface-water resources in the watershed are very limited and the storage and regulation facilities are scarce and expensive. The aquifers are confined by extensive layers of volcanic tuff in the hills and by thick layers of highly compressible volcanic clays in the plains; 1250 deep wells drawing 11.7 cu m/sec from groundwater sources are located in the city area and are the cause of a very serious overdraft. Subsidence over the plain of the Valley of Mexico is uneven and its intensity is a function of pore pressure and of the thickness and mechanical properties of the clay formations. (Gabriel-USGS)
W69-09297

LOCAL AND REGIONAL MINERALIZATION OF KARST GROUNDWATERS AND THEIR VARIATIONS IN THE DEVONIAN LIMESTONES OF THE RHINE SCHISTOSE MOUNTAINS,
Technische Hochschule, Aachen (West Germany).
H. R. Langguth.
Hydrol of Fractured Rocks Vol 2, Proc Dubrovnik Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74, p 672-683, 1967. 12 p, 8 fig, 1 tab.

Descriptors: *Groundwater, *Water chemistry, *Karst, *Limestones, Water analysis, Shales, Geohydrologic units, Biological properties, Magnesium, Calcium, Hydrologic properties, Springs, Alkaline water, Hardness (Water), Carbon dioxide, Tertiary period.
Identifiers: *Western Germany, Rhine river area, Schistose mountains.

Mineralization of karst aquifers located in the Devonian limestones of Western Germany is described on the basis of geological and geochemical data. The limestones are subdivided by faults into isolated segments of relatively small catchment areas. The analysis of groundwaters present in these segments indicates that their chemical composition depends on the geological conditions and biological activities present in these geological blocks, with a regional decrease in mineralization toward the west. Under a complete cover of Tertiary rocks, the groundwaters are of variable character showing cation-exchange and reduction of some anions in passing through glauconitic layers. (Gabriel-USGS)
W69-09298

LATERAL MOVEMENT OF WATER THROUGH THE UNSATURATED ZONE OF AN UNCONFINED AQUIFER,
California Univ., Berkeley. Hydraulic Lab.
Fereidoun Mobasheri, M. Shahbazi, and D. K. Todd.
Calif Univ Water Resources Center Contrib No 106, Nov 1965. 39 p, 10 fig, 3 tab, 12 ref, 2 append.

Descriptors: *Unsaturated flow, *Aquifers, *Groundwater movement, *Model studies, *Hydraulic models, Permeability, Water table, Analytical techniques, Interfaces, Hydraulic conductivity, Moisture tension.
Identifiers: Lateral unsaturated flow.

Unsaturated lateral flow in unconfined aquifers was studied by mathematical analysis, sand-box, and sand-column model studies. The hydraulic conductivity decreased as the negative pressure of the porous media increased. The calculated equivalent depth of the unsaturated zone for the sand used in the investigation was 35 cm. The flow rate through unsaturated zone increased with a decreasing rate as the unsaturated zone depth increased while the hydraulic gradient was kept constant. The rate of lateral flow movement could also be calculated to a reasonable accuracy from flow net diagrams or the graphical integration of the area under a characteristic conductivity curve. An example of the application of the results can be shown by the determination of underflow at Cedar Springs Damsite in Southern California where flow through unsaturated zone was neglected although the average depth of the aquifer was only 12 ft. The material is predominantly medium-grained sand with lenses of gravel and cobbles. As the average depth of the aquifer is 12 ft, the lateral flow through the unsaturated zone could amount to 11% of the total lateral flow. (Knapp-USGS)
W69-09300

THE OPTIMAL YIELD OF AN AQUIFER,
Technion - Israel Inst. of Tech., Haifa.
For primary bibliographic entry see Field 06A.
W69-09371

2G. Water in Soils

SOIL WATER MOVEMENT AS AFFECTED BY DEEP FREEZING,
Forest Service (USDA), St. Paul, Minn. North Central Forest Experiment Station.
Richard S. Sartz.
Soil Sci Soc Amer Proc, Vol 33, No 3, p 333-337 May-June 1969. 5 p, 6 fig, 16 ref.

Descriptors: *Soil water movement, *Frozen soils, *Freezing, *Infiltration, Frost action, Frost, Permeability, Frozen ground, Diffusion, Percolation, Porosity, Unsaturated flow.
Identifiers: Frozen-soil permeability.

Knowledge of water movement into and through frozen soils is needed for studying the hydrologic behavior of northern watersheds. Soil water was logged by the neutron method in both sandy and silty soils over 4 winters in southwestern Wisconsin. Bonded frost depth, which ranged from 8 to 12 cm at maximum penetration, was measured concurrently by frost probe or resistance blocks. Changes in soil water took place throughout much of the frost season, even with deep soil frost. One series of data showed that water may infiltrate and percolate through more than 60 cm of hard-frozen ground. However, frozen ground did impede percolation, causing a buildup of water in the frozen zone during spring melt. Although neutron readings increased at upper levels during the frost season, most of the increases could not be accounted for by decreases at lower levels. Thus, the appeared to result more from infiltration than from upward migration as reported by others. (Knapp-USGS)
W69-09139

ADSORPTION OF NONIONIC SURFACTANTS BY SOIL MATERIALS,
California Univ., Riverside. Dept. of Soils and Plant Nutrition.
N. Valoras, J. Letey, and J. F. Osborn.
Soil Sci Soc Amer Proc, Vol 33, No 3, p 345-348 May-June 1969. 4 p, 7 fig, 1 tab, 9 ref. Grant No 4000 (Forest Service, USDA).

Descriptors: *Adsorption, *Surfactants, *Soils, Wettability, Clays, Solubility, Wetting, Peat, Organic matter, Infiltration, Water chemistry, Water properties.
Identifiers: Micelles, Soil wettability, Water repellent soils.

The adsorption of nonionic surfactants by various soil materials from solution was measured. Most studies were on Aqua Gro and Soil Penetrant--surfactants marketed for use on soils. Aqua Gro was generally adsorbed to a greater extent than Soil Penetrant. Essentially all of Aqua Gro was adsorbed from solution until a given amount of surfactant was adsorbed after which there was only a slight increase in adsorption as the concentration in solution increased. Soil penetrant, on the other hand, was adsorbed to a lesser extent until the concentration in solution was increased to about 50 ppm. At this concentration, there was a very great increase in adsorption to a maximum value after which very little additional adsorption occurred as the solution concentration increased. Equilibrium between the soil and solution was either complete or near completion after one hour. Essentially no Aqua Gro was desorbed as the treated soil was placed in water. Some of the adsorbed Soil Penetrant went into solution as treated soil was placed in water. Since the reaction between soil and surfactant differs for various surfactants, the surfactant which would have optimum properties for a desired effect can be chosen. (Knapp-USGS)
W69-09141

N SITU DETERMINATION OF PHYSICAL ROPERTIES OF THE SURFACE LAYER OF IELD SOILS,
ritish Columbia Univ., Vancouver.
De Vries.
oil Sci Soc Amer Proc, Vol 33, No 3, p 349-353, lay-June 1969. 5 p, 9 fig, 3 tab, 5 ref. Grant No A 556 NRC (Canada).

escriptors: *Soil moisture, *Moisture tension, Tensiometers, *Nuclear moisture meters, Calibraons, Soil moisture meters, Soil physical properes, Moisture content, Water yield, Soil water ovement, Laboratory tests, On-site tests.
lentifiers: *Soil surface layer, Water retention urve, Water retention.

set of gamma ray attenuation vs. soil water atric potential data was obtained in situ by satuting an undisturbed block of soil, and by lowering e water level in steps and measuring the count te through the soil and the corresponding water atric potential at each step. Relative water conents were calculated from the count rates by use of rational calibration equation. The corresponding atric potential was measured with a low imedance tensionmeter. A partial water retention urve was plotted from these data, from which in rn the air intrusion value and the aeration porosi were inferred. It was shown that collimation is ssential for measurements within the 1-cm thick rface layer, but it is not required for measureents within the bulk of a layered system. With a 5-c cesium-137 source, a collimated beam and a 4-in counting time, the precision was 0.6% water ontent due only to errors associated with random mission. There was good agreement between a artial water retention curve obtained in situ and e one obtained with an outflow method in the aboratory. (Knapp-USGS)
W69-09142

IACROSCOPIC SWELLING AND HYDRAULIC CONDUCTIVITY PROPERTIES OF FOUR VERMICULITIC SOILS,
Agricultural Research Service, Riverside, Calif. alinity Lab.
. D. Rhoades, and R. D. Ingvalson.
oil Sci Soc Amer Proc, Vol 33, No 3, p 364-369, lay-June 1969. 6 p, 2 fig, 5 tab, 25 ref.

Descriptors: *Hydraulic conductivity, *Expansive oils, Expansive clays, Soil water movement, Electrolytes, Ion transport, Permeability, Clays, Clay minerals, Mineralogy.
Identifiers: Vermiculitic soils.

The extent to which mixed Na, Ca electrolyte solutions affected the hydraulic conductivity and macroscopic swelling properties of 4 vermiculite soils was determined. Macroscopic swelling did not occur in the under 5 micron fraction of the soils until exchangeable-sodium-percentage (ESP) values in excess of 30 to 60 and electrolyte concentrations of less than 20 meq/liter were established. Decreases in hydraulic conductivities (HC) of soils devoid of montmorillonite did not occur at ESP values less than 50 in the absence of mechanical and chemical disaggregation. After disaggregation, decreases in HC occurred in the ESP range of 10-30 at electrolyte concentrations of 5-10 meq/liter. The concept of 'inactive exchangeable Na' residing in non-clay-sized vermiculite particles is introduced. (Knapp-USGS)
W69-09143

APPRAISAL OF RESEARCH ON SURFACE MATERIALS OF DESERT ENVIRONMENTS,
Arizona Univ., Tucson; and Army Natick Labs., Mass.
Harold E. Dregne.
In W. G. McGinnies, B. J. Goldman, and Patricia Paylore, eds., Deserts of the World, an Appraisal of Research into their Physical and Biological Environments, p 285-377, University of Arizona Press, Tucson, 1968. 93 p, 2 tab, 481 ref.

Descriptors: *Deserts, *Synoptic analysis, Arid lands, Climates, Aeolian soils, Dunes, Soil types, Soil texture, Soil surveys, Soil physical properties, Soil moisture, Soil groups, Soil classifications, Saline soils, Soil tests, Soil analysis, Calcareous soils, Sands, Winds, Moisture availability, Soil stability, Irrigation effects, Trafficability, Soil chemical properties, Soil compaction, Soil contamination effects, Soil engineering, Soil formation, Soil surfaces, Microorganisms, Fungi, Azotobacter, Algae, Soil moisture movement, Evapotranspiration, Saline soils, Sodium, Nitrogen, Organic matter, Bibliography, Hydrogen ion concentration.
Identifiers: Atacama-Peruvian Desert, North American Desert, Termites, Hardpans, Desert pavement, Piping, Kalahari-Namib Desert, Sahara Desert, Somali-Chalbi Desert, Arabian Desert, Iranian Desert, Thar Desert, Turkestan Desert, Takla-Makan Desert, Gobi Desert, Australian Deserts, Monte-Patagonian Desert.

This paper is a survey of the state of knowledge of surface materials in the major desert regions of the world. Existing problems are emphasized and recommendations for future research are made. A resume of principal soils of each desert is presented along with a review of the pertinent literature. Tables list soil authorities and depositories of soils information, both geographically. A variety of aspects of the biological, chemical and physical properties of soils in arid and semiarid regions are discussed. Russian, French, Dutch and U.S. systems of soil classification are compared and the complications resulting from the use of multiple systems is pointed out. The duplication in classification by agricultural soil scientist and soil engineers is examined and suggestions for a unified soil nomenclature system are presented. Data is still very sparce for arid and extremely arid areas, most soils studies resulting from agricultural interests. Development of soils under arid conditions is poorly understood. Confusion in terms, such as color and group names, used to classify arid-zone soils, is a major deficiency. Soil-water ratio dilutions for pH and soluable salts are frequently not indicated in the literature, making reliable comparisons impossible. Improved methods are needed for determining soil texture, soil aggregation, exchangeable calcium and magnesium in calcareous soils, and exchangeable sodium in highly saline soils. Studies are needed in trafficability. (See W69-09206). (Sherbrooke-Ariz)
W69-09208

NUMERICAL ANALYSIS OF PONDED RAINFALL INFILTRATION,
Geological Survey, Menlo Park, Calif. Water Resources Div.
J. Rubin.
Proc Wageningen Symp on Water in the Unsaturated Zone, Int Ass Sci Hydrol Pub No 82, p 440-451, 1969. 12 p, 5 fig, 8 ref.

Descriptors: *Infiltration, *Unsaturated flow, *Soil water movement, Surface-groundwater relationships, Soil moisture, Rainfall intensity, Mathematical models, Digital computers, Permeability, Porosity, Particle size, Hydraulic gradient, Water spreading, Flooding.
Identifiers: *Ponded infiltration.

The preponding and ponded stages of rainfall infiltration were studied by solving numerically the partial differential equation of downward moisture flow in unsaturated soils. To make such a study possible, the previously developed numerical method for rain infiltration analysis was appropriately modified. The modified method was used for computing moisture content and pressure head profiles during preponding and ponded rainfall infiltration, as well as the theoretically expected rainfall infiltration rates. In particular, the dependence of the above profiles and rates upon rain intensity was studied. One of the conclusions reached was that the theoretical relations between ponded rainfall infiltration rates and infiltration duration, computed for rains of various intensities, cannot be expressed by a single curve. These relations also differ significantly from the flood-water infiltration capacity-time function. (Knapp-USGS)
W69-09264

FLOWS AND CYCLES OF MACRO- AND MICRO-ELEMENTS IN A FOREST SOIL AND ITS ENVIRONMENT,
Department of Scientific and Industrial Research, Lower Hutt (New Zealand).
For primary bibliographic entry see Field 02K.
W69-09343

STEADY STATE STUDIES OF NITRIFICATION IN SOIL: THEORETICAL CONSIDERATIONS,
California Univ., Berkeley. Dept. of Soils and Plant Nutrition.
For primary bibliographic entry see Field 02K.
W69-09345

DETERMINATION OF SOIL CATION EXCHANGE CAPACITY BY A SIMPLE SEMIMICRO TECHNIQUE,
Wisconsin Univ., Madison. Dept. of Soils.
For primary bibliographic entry see Field 02K.
W69-09346

RADIATION AS A TECHNIQUE IN SOIL BIOLOGY AND BIOCHEMISTRY,
California Univ., Davis. Coll. of Agriculture.
For primary bibliographic entry see Field 02K.
W69-09350

RESPONSE OF CHEMOAUTOTROPHIC NITRIFIERS TO FOREST CUTTING,
Yale Univ., New Haven, Conn.; and Dartmouth Coll., Hanover, N.H.
For primary bibliographic entry see Field 02K.
W69-09351

2H. Lakes

MOTIONS IN A MODEL GREAT LAKE DUE TO A SUDDENLY IMPOSED WIND,
Waterloo Univ. (Ontario).
G. T. Csanady.
Journal of Geophysical Research, Vol 73, No 20, p 6437-6447, Oct 1968. 11 p, 3 fig, 5 tab, 9 ref.

Descriptors: *Great Lakes, *Hydrodynamics, *Wind velocity, *Water waves, *Water currents, Rotational flow, Friction, Thermocline, Seiches, Coriolis force, Density stratification, Model study, Interfaces.
Identifiers: *Wind-stress system, Inertial periods, Coastal jets, Poincare waves.

A solution is presented for the initial value problem that arises when a uniform wind stress is suddenly imposed on the surface of a circular, constant depth, two-layer lake that has similar characteristics to the Great Lakes under summer conditions. Even with this minimum number of dynamically significant features in the theoretical model (closed basin, two-layer structure, and constant Coriolis parameter) a number of experimentally found features in the behavior of the Great Lakes are reproduced in a realistic way, the most important such phenomena being (1) large thermocline movements near the shores, (2) coastal jets, (3) rotary currents in the center portion, (4) standing internal waves of long wavelength and large amplitude, (5) standing surface seiches, and (6) rotating surface and internal seiches. Data and models are shown in tables and figures. (Sherman-Vanderbilt)
W69-09046

CHEMICAL AND MINERALOGICAL CHARACTERISTICS OF EUTROPHIC LAKE SEDIMENTS,
Connecticut Agricultural Experiment Station, New Haven.
For primary bibliographic entry see Field 05C.

W69-09144

THERMAL INFLUENCE OF THE LAKE INAWASHIRO ON THE LOCAL-CLIMATE IN SUMMER DAYTIME,
Tohoku Univ., Sendai (Japan). Faculty of Science.
Hiroshi Shitara.
Sci Rep of Tohoku Univ, 7th Ser (Geogr), Vol 18, No 2, p 213-220, Mar 1969. 8 p, 8 fig, 1 ref.

Descriptors: *Lakes, *Thermal properties, *Climates, Air temperature, Winds, Cloud cover, Rain, Altitude, Micrometeorology, Weather data, Weather patterns.
Identifiers: *Japan, Lake thermal effect, Lake Inawashiro.

In this paper the author summarized the results of his daytime observations conducted in 1967 and on July 10, 1968. The air temperature difference at 1.5 m-level between the windward shore and the leeside shore is larger when the wind is blowing across the lake under the clear weather. When the air-flow from the lake surface alternates with that from the inland, there is a sudden drop in the air temperature. Horizontal air temperature change on the lake is large in the windward area, in accordance with the distance from the windward shore, while it is small in the leeside area. Vertical air temperature gradient (1.5 m - 5.0 m) under clear weather is far stronger on the windward shore than on the leeside shore. Under clear weather, the characteristics with the incoming type in micro-climate is observed in the vertical air temperature profile blow 3.0 m-level, and it disappears at a location 200 meters distant from the windward shore, and appears again in the plain near the leeside shore. The air temperature difference, between the location on the lake near the windward shore free from the micro-climate on the ground and the leeside shore, is about 2.0 deg C, which is estimated as the thermal influence of the lake surface upon the local climate, within the limits of these observations. (Gabriel-USGS)
W69-09150

DEGRADATION OF GAMMA - BHC IN SIMULATED LAKE IMPOUNDMENTS AS AFFECTED BY AERATION,
Wisconsin Univ., Madison. Dept. of Soils.
For primary bibliographic entry see Field 05C.
W69-09227

MONTHLY SURVEY OF VITAMIN B-12 CONCENTRATIONS IN SOME WATERS OF THE ENGLISH LAKE DISTRICT,
National Inst. for Research in Dairying, Reading (England). Unit for Biochemical Research Bearing on Fish Problems.
K. W. Daisley.
Limnol and Oceanogr, Vol 14, No 2, p 224-228, Mar 1969. 5 p, 3 fig, 22 ref.

Descriptors: *Lakes, *Vitamin B, Chemical analysis, Organic matter, Nutrients, Sediments, Ecology, Algae, Seasonal, Analytical techniques, Bacteria, Mapping, Silting.
Identifiers: *England, English Lakes, Vitamin B-12.

The vitamin B-12 activity for 'Euglena gracilis' of water from 9 lakes of the English Lake District was assayed at 15 consecutive monthly intervals. Filtration through glass-fiber filters was used to differentiate between dissolved vitamin and that in gross particulate matter. The average vitamin B-12 concentrations correlated with the so-called, evolutionary series of the lakes: the primitive rocky lakes of low productivity are low in vitamin B-12 and the 'evolved' silted lakes, richer in sediments, nutrients, and organisms have higher levels of the vitamin. There is also some indication of seasonal variations at some lakes but the differences are much smaller than the seasonal algae changes. (Gabriel-USGS)
W69-09254

STUDIES ON THE DISTRIBUTION OF COBALT IN LAKES,
Wisconsin Univ., Madison. Limnology Lab.
Michael Parker, and Arthur D. Hasler.
Limnol and Oceanogr, Vol 14, No 2, p 229-241, Mar 1969. 13 p, 5 fig, 5 tab, 42 ref.

Descriptors: *Lakes, *Cobalt, Water chemistry, Seasonal, Statistical methods, Water temperature, Dissolved oxygen, Sampling, Drainage, Organic matter, Radioactivity, Conglomerate rocks, Photosynthesis, Phytoplankton.
Identifiers: Wisconsin lakes, Cobalt distribution.

Distribution of cobalt was investigated by adding cobalt-57 to bottles of lake water to see whether there was any seasonal change in the distribution of cobalt in filtrates (solutions) and seston after 24-hour incubation, or whether any differences in this distribution could be found between lakes. Several distinct patterns of seasonal distribution of Cobalt-57 between 'solution' and seston were observed but no explanation of the basic mechanism causing these changes can be offered. In general, direct biological uptake did not appear to be significant in removing Cobalt-57 from solution (Lake Mendota, Wisconsin). Photosyntheic activity was of little importance. Experiments with inhibitors and heated waters indicated the importance of nonbiological processes. Algae showed very little radioactivity (Gabriel-USGS)
W69-09255

DISTRIBUTION OF OLIGOCHAETES IN WESTERN LAKE ERIE, 1961,
Bureau of Commercial Fisheries, Ann Arbor, Mich. Biological Lab.
Jarl K. Hiltunen.
Limnol and Oceanogr, Vol 14, No 2, Mar 1969. p 260-264, 5 p, 9 fig, 15 ref.

Descriptors: *Oligochaetes, *Lakes, *Lake Erie, Sampling, Tubificids, Estuaries, Rivers, Pollutant identification, Mapping, Runoff, Ecology, Ecological distribution.
Identifiers: Lake Erie oligochaetes.

A total of 52,390 oligochaetes were collected from 40 stations in western Lake Erie in spring 1961. The population was composed of 2 families, Naididae and Tubificidae. Only 6 species of naidids were found. One, Paranais frici, is apparently new to the list of North American freshwater Naididae. Among the 14 tubificids found, 5 species of Limnodrilus were most abundant; they contributed 90% or more of all oligochaetes at 33 of the 40 stations. Numbers of Limnodrilus were generally large near the mouths of the Detroit, Raisin, and Maumee rivers and decreased progressively lakeward. Stylodrilus heringianus, a pollution-intolerant species common in eastern Lake Erie, was not found in the western end of the lake. (Gabriel-USGS)
W69-09256

A HORIZONTAL WATER SAMPLER FOR INVESTIGATION OF STRATIFIED WATERS,
Wisconsin Univ., Milwaukee. Center for Great Lakes Studies.
Richard P. Howmiller, and William E. Sloey.
Limnol and Oceanogr, Vol 14, No 2, p 291-292, Mar 1969. 2 p, 3 fig, 5 ref.

Descriptors: *Sampling, *Instrumentation, *Stratification, Turbidity, Carbon, Electrical equipment, Water chemistry, Physical properties, Biological properties, Hydrologic properties.
Identifiers: Water samplers, Stratified waters.

Turbid waters frequently show physical, chemical, and biological stratification. To identify and record the data of these stratifications, a water sampler was designed. The triggering mechanism of this water sampler is similar to that used on most Ekman grabs. The sampler is designed for easy manipulation even with heavy gloves during winter sampling. The supporting line passing through the center of the triggering mechanism may continue down to support several samplers to be tripped in series. Two years of intensive year-round sampl
have shown no malfunction with this samp
(Gabriel-USGS)
W69-09257

QUATERNARY LAKES OF EASTERN BRAZI
Heidelberg Univ. (West Germany). Geologic
Paleontological Inst.
R. Pflug.
Photogrammetria, Vol 24, No 1, p 29-35,
1969. 7 p, 3 fig, 5 ref.

Descriptors: *Aerial photography, *Geomorpho
gy, *Lakes, *Pleistocene epoch, Sedimentati
Dams, Erosion, Flood plains, Rivers, Terrain ana
sis, Topography.
Identifiers: *Brazil, Rio Doce River.

In the middle course of the Rio Doce, an east
Brazilian river approximately 700 km long, oc
hundreds of dammed valley lakes. These lakes
restricted to a hilly terrain which accompanies
river in a width of more or less 20 km. The lak
whose water levels now stand about 20 m above
Rio Doce, were formed during a semi-arid cyc
According to a preliminary C-14 determinati
(14,160 plus or minus 500 years) this cycle c
responds to the last ice age of the Northern He
sphere. The process of formation of these lak
deducible from the interpretation of aerial pho
graphs, was damming of clear tributary streams
the aggrading Rio Doce during the late Pleistoce
epoch, followed by recent downcutting of the riv
(Knapp-USGS)
W69-09260

**AN ISOTOPE SURVEY OF LAKES IN T
KARST REGION OF SOUTHERN TURKEY,**
International Atomic Energy Agency, Vien
(Austria).
Turgut Dincer, and Bryan R. Payne.
Hydrol of Fractured Rocks Vol 2, Proc Dubrov
Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74
654-661, 1967. 8 p, 5 fig, 1 tab.

Descriptors: *Radioisotopes, *Lak
*Radiochemical analysis, *Karst, Geochemist
Turnovers, Oxygen, Hydrogen, Chlori
Hydrogen ion concentration, Tritium, Sin
Hydrological properties, Precipitation (
mospheric), Drainage, Water balance, Runo
Limestones, Spring waters.
Identifiers: *Turkey, Mediterranean coast, Cent
Analtolia, Egridir and Beysehir Lakes.

Some lakes located in the Karst region of southe
Turkey were investigated for the presence of sta
and radioactive isotopes of hydrogen and oxyg
The study shows that on the basis of chloride co
centration these shallow lakes may be assumed
be well-mixed reservoirs and the turnover time c
be estimated by comparing actual tritium conce
tration curves with theoretical curves based
tritium fallout in the region. The turnover time
turn gives some information concerning losses t
ing place through sinkholes. The article contain
description of the lakes, an explanation of t
water balance, a reconstruction of the tritium f
lout curves, and explains the interpretation of da
(Gabriel-USGS)
W69-09295

**WIND-DRIVEN SUMMER CIRCULATION
THE GREAT LAKES,**
Waterloo Univ. (Ontario).
G. T. Csanady.
Journal of Geophysical Research, Vol 73, No 8
2579-2589, April 15, 1968. 3 fig, 9 ref.

Descriptors: *Great Lakes, *Water circulatio
*Water currents, Hydrology, Thermocline, Dens
stratification, Wind, Kinetics, Friction, Model s
dy, Lakes.
Identifiers: *Wind-driven circulation, *Radius
deformation, *Wind-stress system, Barocli
Barotrope.

nplified models of wind-forced motions are con-
lered in the two-layer circular basin 'model Great
ke' introduced in an earlier paper. Under
mmer conditions, when a thermocline is present,
th a uniform, steady wind and a uniform wind
rying periodically in time produce a frictionless
se response characterized by strong boundary
rrents and pronounced thermocline movements
the shore zone. The length scale determining the
dth of this shore zone is the 'radius of deforma-
n', typically three miles. Observations on Lakes
ron, Michigan, and Ontario show such motions
be present near the shores. (Sherman-Van-
rbilt)
69-09308

ARGE-SCALE MOTION IN THE GREAT AKES,
aterloo Univ. (Ontario).
T. Csanady.
urnal of Geophysical Research, Vol 72, No 16, p
51-4162, Aug 15, 1967. 4 fig, 1 tab, 24 ref.

escriptors: *Great Lakes, *Density stratification,
hermocline, *Water circulation, *Hydrodynam-
s, *Water currents, *Coriolis force, *Hydrostatic
essure, Continuity equation, Model studies, Lim-
logy, Rotational flow, Lakes.
entifiers: *Large-scale motion, *Rossby number,
astal jets, Kelvin waves.

rge-scale motion in the Great Lakes can be as-
med to be of small Rossby number, so that the
uations of motion can be linearized and at the
me time the variation of the Coriolis parameter
th latitude can be neglected. When applied to a
o-layer lake model, the equations of motion and
e continuity equations can be reduced to two in-
pendent sets of equations for the principal 'inter-
l' and 'surface' modes. When applied to a circu-
basin, constant depth 'model Great Lake' (of
mensions and other characteristics appropriate to
e Great Lakes) the theory suggests the existence
(1) baroclinic coastal jets during the summer
atification; (2) slow counterclockwise rotating
ternal waves of a period many times the half-pen-
lum day; and (3) surface and internal seiches
tating in either direction and having a period of
most several hours (surface modes) or up to
thin a small fraction of the inertial period (inter-
l modes). An examination of the available obser-
tional material indeed suggests that these fea-
res are detectable in the Great Lakes. (Sherman-
nderbilt)
69-09310

IND-DRIVEN CIRCULATION IN UN-TRATIFIED LAKES,
ripps Institution of Oceanography, La Jolla,
lif.
hn A. T. Bye.
mnology and Oceanography, Vol 10, No 3, p
1-458, 1965. 3 fig, 1 tab, 10 ref.

escriptors: *Water circulation, *Wind velocity,
Vater currents, *Flow profiles, *Lakes,
Reynolds number, Theoretical analysis, Limnolo-
, Air-water interfaces, Laboratory tests, Hydrolo-
, Turbulence.
entifiers: Unstratified lakes, Wind-driven circula-
n.

bservations of the wind-driven circulation in the
rtical plane of unstratified lakes, including some
w results indicating a logarithmic current profile
ar the lake surface, are presented. The current
ofile was deduced from the varying velocities of
ats of different lengths at wind speeds less than
m/sec and found independent of wave action.
e velocity profile has not been measured in lake
nditions except at a depth of one meter, but in
boratory observations it has the features that (1)
e velocity and velocity gradients are large near
e surface, and (2) near the bottom there is a thin
yer where the return current is reduced to zero. A
eoretical velocity profile that is in fair agreement
th a stressdriven laboratory flow, and that may
pproximate to the steady circulation in the central section of lakes of nearly uniform depth, is developed. From this profile, an estimate is made of the effect on the wind setup of a gentle sloping lake bottom. (Sherman-Vanderbilt)
W69-09314

EUTROPHICATION OF THE ST. LAWRENCE GREAT LAKES,
Bureau of Commercial Fisheries, Ann Arbor, Mich.
For primary bibliographic entry see Field 05C.
W69-09315

ZINC-65 IN STUDIES OF THE FRESHWATER ZINC CYCLE,
Michigan Univ., Ann Arbor. Dept. of Zoology.
Roger W. Bachmann.
Proc 1st Nat Symp on Radioecology, Colorado State Univ, Fort Collins, Sept 10-15, 1961. Radioecology, 1963, Reinhold Pub Corp, NY and Amer Institute of Biological Sciences, Wash, DC, Schultz, Vincent and Klement, Jr, Alfred W (Eds), p 485-496. 7 fig, 9 tab, 53 ref.

Descriptors: *Zinc radioisotopes, *Freshwater, Michigan, Lakes, Tracers, Detritus, Sediments, Seston, Daphnia, Mayflies, Adsorption, Mathematical models, Aquatic plants, Chelation, Synthesis, Enzymes, Algae, Sampling, Radioactivity, Hydrogen ion concentration, Temperature, Alkalinity, Zooplankton, Benthic fauna, Calcium, Magnesium, Potassium, Sodium, Phytoplankton.
Identifiers: *Zinc cycle, Ann Arbor (Mich), Golenkinia paucispina, Daphnia pulex, Daphnia magna, Ephemera simulans, Suspended materials, Inorganic complexes, Elodea canadensis, Ceratophyllum demersum, Potomogeton richardsonii, Ankistrodesmus, Radionuclide uptake.

Author determined quantitatively some of the factors affecting distribution of zinc between the water and various solid materials in lakes. The uptake of zinc by suspensions including Golenkinia paucispina, organic detritus, lake sediments, and natural lake seston was measured with zinc-65, as tracer; and zinc uptake by Daphnia pulex and Daphnia magna was followed. Daphnia pulex takes up zinc primarily from particles to which zinc is adsorbed. When nymphs of Ephemera simulans were present, the zinc was mixed into sediments and approached a uniform distribution. Nymphs did not accumulate a significant fraction of zinc available. Theoretical curves were derived predicting zinc distribution between liquid and solid phases in lakes as a function of total zinc content and suspended material mass. A theoretical outline of the freshwater zinc cycle was then presented, characterized by exchanges between dissolved zinc and various organic and inorganic suspended materials, including rooted aquatic plants and bottom sediments. Transfer of zinc to sediments by sedimentation of adsorbents seem to be a mechanism for removal of the ion from lake waters. Accumulation of zinc in sediments should result. Formation of organic chelates and inorganic complexes may be factors altering the scheme proposed. (See also Vol 2, No 19, Field 5C, W69-07863). (Jones-Wis)
W69-09332

CONTROL OF MIXED-SUBSTRATE UTILIZATION IN CONTINUOUS CULTURES OF ESCHERICHIA COLI,
Massachusetts Inst. of Tech., Cambridge. Dept. of Nutrition and Food Science.
For primary bibliographic entry see Field 02K.
W69-09341

THE PHOSPHORUS FRACTIONS AND THE TURNOVER TIME OF INORGANIC PHOSPHORUS IN DIFFERENT TYPES OF LAKES,
Toronto Univ. (Ontario). Dept. of Zoology.
F. H. Riger.
Limnology and Oceanography, Vol 9, No 4, p 511-518, 1964. 2 fig, 4 tab, 16 ref, disc.

Descriptors: *Lakes, *Phosphorus compounds, *Phosphorus, Limnology, Seston, Seasonal, Plankton, Cycling nutrients, Phosphorus radioisotop
Hydrogen ion concentration, Hardness, Colc
Stratification, Eutrophication, Analytical method
Identifiers: *Lake typology, *Turnover tim
Phosphorus (Inorganic), Phosphorus (Soluble organic), Phosphorus (Colloidal), Phosphorus (Soluble reactive), Phosphorus (Total), Millipore filtration, Toronto (Ont), Algonquin Provincial Park (Ont), Canada, Ontario, Lake size, Urban drainage, Bog lakes, Grenadier Pond (Ont), Heart Lake (Ont), Teapot Lake (Ont), Mary Lake (Ont), Eos Lake (Ont), Costello Lake (Ont), Opeongo Lake (Ont), Lake of Two Rivers (Ont), Found Lake (Ont).

Author reports concentrations of inorganic phosphorus (P), soluble organic P, and seston P, studied throughout one year in nine Ontario lakes, differing in size total P concentration, and water color. Percentages of total P occurring as soluble organic P were similar in eight lakes (range: 25.0-31.7%), and divergent (12.5%) in extremely eutrophic Grenadier Pond, which receives urban drainage. Author accounts for differences between his results and those reported in the literature by others as due to varied techniques used, and presents experimental evidence to support this view. Millipore filtration (pore diameter: 0.1 micron) reduced soluble organic fraction to 18% of total P. Turnover time of inorganic P was less than 10 minutes in all lakes during summer, but increased in winter (in Heart and Mary Lakes, by as much as three orders of magnitude). Report presents experimental data to show that use of unwashed Millipore filters adds P to filtrate. (Eichhorn-Wis)
W69-09342

WATER-QUALITY MANAGEMENT AND LAKE EUTROPHICATION: THE LAKE WASHINGTON CASE,
Washington Univ., Seattle. Dept. of Zoology.
For primary bibliographic entry see Field 05G.
W69-09349

ON THE CONSEQUENCES WHICH LOWERINGS OF THE WATER LEVEL FOR AGRICULTURAL PURPOSES HAVE ON MACROPHYTIC AND PLANKTONIC COMMUNITIES OF SHALLOW LAKES WITHIN THE OLIGOTROPHIC AREA OF SOUTH SWEDEN, (GERMAN),
Lund Univ. (Sweden). Limnological Inst.
Sigvard Lillieroth.
Acta Limnologica 3, 1950, Carl Bloms Boktryckeri, Lund, Sweden. 288 p, 64 fig, 26 tab, 158 ref.

Descriptors: *Eutrophication, *Lakes, *Phytoplankton, Shallow water, Nutrients, Plankton, Water levels, Water level fluctuations, Aquatic plants, Drainage effects, Drawdown.
Identifiers: *Sweden, *Macrophytes, *Auxotrophication, Phragmites, Scirpus, Typha, Equisetum fluviatillis, Gyttja.

The biomass of aquatic vegetation was studied in five shallow lakes located in an limnologically uniform area of glacial deposits. The water level of three of these lakes was lowered from 1.2 to 2.0 meters by artificial drainage of surrounding wet lowlands. This amelioration induced an increase of nutrients for both macrophytes and microphytes. The increased fertility of the lakes was particularly reflected in the colonization of available areas of gyttja by gramineous communities, largely those of Phragmites, Scirpus, Typha, and Equisetum fluviatile. The eutrophication of the lakes was interpreted as 'auxotrophication,' a term implying an augmented productive capacity of the basin due to either an increase in concentration of soluble salts, or a mobilization of previously unutilized latent supply of nutrients. (Wilde-Wis)
W69-09352

2I. Water in Plants

CO sub 2 - GAS EXCHANGE AND WATER RELATIONS OF PLANTS IN THE NEGEV DESERT AT THE END OF THE DRY PERIOD,
Hebres Univ., Jerusalem (Israel).
O. L. Lange, W. Koch, and E. D. Schulze.
Ber. Deutsch Botan Gesell, bd 82, hft 1/2, p 39-61, 1969. 23 p, 19 fig.

Descriptors: *Moisture stress, *Photosynthesis, *Arid climates, Deserts, Arid lands, Drought resistance, Heat resistance, Physiological ecology, Plant physiology, Stomata, Transpiration control, Water.
Identifiers: Israel, Negev Desert, CO sub 2.

The aim of this study was the clarification of how different plants survive the dry period and to what extent positive net-photosynthesis under high water stress is possible. In order to investigate the gas exchange under the most natural conditions, the experimenters used the Siemens gas-exchange chamber with temperature and humidity control. This control allowed elimination of the glasshouse effect. Daily net-photosynthesis and transpiration were determined under natural diurnal course conditions. In addition, a number of experiments were performed in order to analyze the effect of the temperature, independent from the ambient. Under natural conditions, the diurnal course of net-photosynthesis varies in number and form of peak according to the species. It was shown that increased resistance as well as the mid-day closing of the stomata are brought about directly by the temperature. This reaction, temperature species specific, protects the plant against further impairment of its already stressed water conditions. The same leaf temperature in the presence of different water contents can have an entirely different effect, temperature sensitivity being increased with a corresponding water stress. The daily balance of the net-assimilation and the assimilation-transpiration quotient of several wild and cultivated plants are compared. Perennial desert xerophytes are able to stabilize their water relations in a manner that allows them to maintain positive daily balance of the CO sub 2 gas exchange even at the end of the period. (Sherbrooke-Ariz)
W69-09204

REVEGETATION PROCEDURES FOR IMPROVEMENT OF THE SAN SIMON WATERSHEDS,
Arizona Univ., Tucson. Dept. of Watershed Management.
For primary bibliographic entry see Field 04D.
W69-09205

2J. Erosion and Sedimentation

STUDY OF EROSION PHENOMENA AND UNCONSOLIDATED DEPOSITS IN BAIE-SAINT-PAUL-SAINT-URBAIN AREA, CHARLEVOIX COUNTY,
Department of Natural Resources, Quebec. Geological Exploration Service.
Jean-Y. Chagnon.
Geol Explor Serv, Quebec Dep Natur Resources Spec Pap No 3, 1969. 29 p, 6 fig, 8 plate, 8 ref.

Descriptors: *Erosion, *Sediments, *Topography, *Deposition (Sediments), Drainage, Bedrock, Rivers, Geology, Quaternary period, Glaciation, Gravels, Sands, Clays, Lakes, Rain, Remedies, Erosion control, Landslides.
Identifiers: *Canada, Quebec, Charlevoix County.

This report presents a study of unconsolidated sediments in Charlevoix County, Quebec, with a special reference to the erosion phenomena taking place along the Gouffre River. The results of the erosive processes are evident at numerous points along the Gouffre River Valley. Landslides, riverbank erosion, solifluction, and reptation phenomena are abundant, and the river causes considerable damage to the riparian farms. The report describes the topography, drainage, bedrock, and geology of unconsolidated deposits and suggests some methods to control the erosive processes taking place in the Baie-Saint-Paul-Saint-Urbain Area. (Gabriel-USGS)
W69-09151

THE BEHAVIOR OF STRAIGHT OPEN CHANNELS WITH MOVABLE BEDS,
Geological Survey, Washington, D.C.
Thomas Maddock, Jr.
Geol Surv Prof Pap 622-A, p A1-A70, 1969. 70 p, 52 fig, 3 tab, 60 ref.

Descriptors: *Alluvial channels, *Sediment transport, *Channel morphology, Open channel flow, Regime, Sedimentation, Model studies, Hydraulic models, Hydraulics, Bed load, Particle size, Particle shape.
Identifiers: Alluvial channel behavior.

The chief variables related to the behavior of alluvial channels are mean velocity, depth, width, slope, quantity of sediment transport, and sediment size composition. Because changes in one variable result in mutual adjustment of all other variables, the actual results depend on the constraints that may be imposed, either natural or artificial. Analysis of flume data indicates that no single simple equation describes the relation between mean velocity and load, the sediment discharge per foot of width of channel. Different equations for unigranular sediment and for sediment mixtures are proposed. These equations are based on flume data and are tested with data collected in the field. (Knapp-USGS)
W69-09155

THE LACUSTRINE BEDS OF WADI FEIRAN, SINAI: THEIR ORIGIN AND SIGNIFICANCE,
Geological Survey of Israel, Jerusalem. Hydrogeology Div.
A. Issar, and Y. Eckstein.
Israel J Earth-Sci, Vol 18, No 1, p 21-27, 1969. 7 p, 11 fig, 9 ref.

Descriptors: *Lake beds, *Arid lands, *Sedimentation, Sediments, Deposition (Sediments), Erosion, Sediment transport, Paleolimnology, Paleoclimatology, Pleistocene epoch.
Identifiers: Israel, Sinai.

Wadi Feiran and its tributaries, Sinai, dissect a series of yellowish silt s and clays interbedded with minor sands and gravels. They are considered to originate from local lacustrine or swampy conditions, which were intermittently disrupted by violent floods. Deposits of several such ancient shallow lakes or swamps were observed at different topographic levels, separated by natural barriers of resistant dikes. The lakes are thought to have been formed during late Plio-Pleistocene times, when more humid climatic conditions prevailed. (Knapp-USGS)
W69-09156

THE GEOCHEMISTRY OF MOLYBDENUM IN THE BLACK SEA,
Akademiya Nauk SSSR. Institut Okeanologii.
M. F. Philipchuk, and I. I. Volkov.
Transl from Russian Litologiya i Polezn Iskop, No 4, p 5-27, July-Aug 1968. Lithology and Mineral Resources, No 4, p 389-407, July-Aug 1968. 19 p, 8 fig, 7 tab, 43 ref.

Descriptors: *Geochemistry, *Molybdenum, *Sediments, *Sea water, *Bottom sediments, Diagenesis, Organic matter, Sulfides, Pyrite, Mudflows, Basalts, Coals, Oxidation, Erosion, Clays, Muds, Silts.
Identifiers: *Black Sea, Sediment redistribution.

Distribution of molybdenum in the surface l and in a vertical section of the Black Sea sedim was investigated by analyzing for molybde hydrogen sulfide, organic carbon, and calcium bonate contents. It was established that Mo co of the sea water varies from 0.5 to 6.4 microg per liter whereas the Mo in the surface layer v with type of layer sediment. In the vertical se of the bottom sediments, maximum concentra of Mo, which is up to 200 ppm, is limited to the Black Sea deposits (sapropelic coals) enriche organic material and reduced sulfur compo (pyrite, organic sulfur). Muddy water data indi a very high mobility of Mo in diagenesis. (Gab USGS)
W69-09161

CHARACTERISTICS OF SEDIMENTATION THE SHELF OF SOUTHWESTERN AFRICA
Atlantic Scientific Res Inst. of Fisheries Oceanogr., Kaliningrad (USSR).
Yu. M. Senin.
Transl from Russian Litologiya i Polezn Iskop 4, p 108-111, July-Aug 1968. Lithology Mineral Resources, N o 4, p 476-479, July 1968. 4 p, 1 fig, 1 tab, 12 ref.

Descript ors: *Sedimentation, *Marine geo *Atlantic Ocean, *Continental shelf, Arid clim Weathering, Runoff, Nutrients, Ocean curr Biomass, Zooplankton, Phytoplankton, Temp ture, Water chemistry, Silts, Clays, Phospho Sands.
Identifiers: *Africa, Shelf sediments.

Results of studies of 180 bottom samples of tinental shelf sediments from southwestern Af collected in 1963-1964, are presented. The e ples were analyzed by using microscopic, gr lometric and chemical methods. In general hydrologic conditions of this shelf (in an arid mate) are determined by the complex interac of the waters of the cold Benguela Current, warm and saline waters of a southern current deep waters which upwell onto the shelf. dynamic regime of the shelf is characterized considerable activity; the speed of the Beng Current is about 25 cm/sec. and the speed of and-flow tides is 25 cm/sec. The climatic hydrochemical characteristics of the region clearly reflected in the physical and chemical c positions of the bottom sediments and in the tribution of their granulometric and phys genetic types. One of the characteristics of the s sediments is the widespread occurrence of rigenous, diatomaceous, and glauconitic sedime where the formation of diatomaceous oozes glauconitic sands is obviously related to the st constant upwelling of cold deep waters. (Gab USGS)
W69-09162

PEBBLE ORIENTATION IN A RECE GRAVEL CHANNEL,
Akademiya Nauk SSSR. Sibirskoe Otdelenie stitut Geologii i Geofiziki.
V. I. Levin.
Transl from Russian Litologiya i Polezn Iskop. 4, p 126-130, July-Aug 1968. Lithology Mineral Resources, No 4, p 497-500, July- 1968. 4 p, 2 fig, 2 tab, 5 ref.

Descriptors: *Gravels, *Streamflow, *Eros *Deposition (Sediments), Gold, Mining, C glomerate rocks, River beds, Mathematical stud Statistical methods, Currents (Water).
Identifiers: *Gravel channel, Pebble orientat Yakutia (Siberia).

Pebble orientations in a small gravel channel of Mulam River (southern Yakutia) were investig and the results plotted as the petrofabric diagr of elongate-flattened and rod-shaped pebbles. elongate-flattened pebble generally has its m imum projection area dipping upstream with long 'a' axis crosswise to the current; at the side the stream the long axis of the rod-shaped

r-shaped pebbles usually has the same orienta- n as the 'a' axis of the elongate-flattened pebbles l in the center it is generally parallel to the cur- t with a tendency to dip downstream. The paleo- struction of a water current may be achieved by nparing the orientation of the 'a' axes of elon- e-flattened and rod-shaped or pear-shaped peb- s. (Gabriel-USGS)
9-09163

THEMATICAL ESTIMATE AND SELEC- ON OF OPTIMAL CONDITIONS OF GRANU- METRIC ANALYSIS BY THE HYDRAULIC THOD,
A. Guseinov, and N. I. Dyudneva.
nsl from Russian Litologiya i Polezn Iskop, No p 148-153, July-Aug 1968. Lithology and neral Resources, No 4, p 521-526, July-Aug 8. 6 p, 1 fig, 2 tab, 10 ref.

scriptors: *Mathematical studies, *Mathemati- models, *Clays, *Settling velocity, *Hydraulic dels, Velocity, Stokes law, Hydraulic properties, imentation.
ntifiers: *Granulometric analysis, Clay particle ling.

purpose of this brief article is to give an ac- nt of the separation of clay fractions, estimation he hydraulic method of granulometric analysis, the selection of the optimal condition for max- m preservation of particles with a diameter less n 0.01 mm. The rate of settling was investigated sing the Stokes formula modified by B. V. Ark- gel, Skiy (1935) and several decantations. It found that one isolated particle settles more idly than a group of interacting particles; parti- of diameter 0.01-0.05 mm have a velocity scat- ng of 50%, and particles of diameter 0.05-0.1 , 20%. This indicates a decrease of particle in- ction with an increase of diameter. The All on Research Institute method of granulometric lysis was found to be the most reliable for bed relation since losses of particles of the limiting meter in this case are minimized. The article usses the sources of possible errors in studying settlement of particles under still-water condi- s. (Gabriel-USGS)
9-09164

E LENGTH OF RIVER-BED CONSOLIDA- N DOWNSTREAM FROM DAMS (ROMANI-
),
itute of Hydrotechnical Research, Bucharest mania).
est Razvan.
rotechnica, Gosp Apelor, Meteorol, Vol 13, No 219-226, May 1968. 8 p, 9 fig, 4 tab, 9 ref.

scriptors: *Scour, *Dams, *River beds, River ning, Engineering structures, Turbulent flow, k erosion, Bank stabilization, Particle size, ude number, Coriolis force, River basins, ers, Hydraulic properties, Roughness (Hydrau-

ntifiers: *Romania, River bed consolidation.

dams built in the 18th century in Romania had provision for consolidation below the dam. Most these dams were either abandoned or lernized. A dissipation basin was designed to in the water at the dam foot for any variation of er level downstream. This paper discusses the oretical consideration which needs to be taken downstream consolidation. Coriolis force, ude number and other hydraulic conditions are ussed. It is recognized that the movement of cohesive bed particles by a macio-turbulent is different from the movement of particles in ormal turbulent flow. Critical velocity of bed erial depends on the specific density, ivalent diameter, relative roughness, and inten- of macroturbulence. The initial movement of icles is related to the frontal hydrodynamic e, upward lifting force, and friction force. The th of consolidation and depth of scouring nstream from dams are recommended mea- sures in preventing the uncontrolled erosion of river banks and watercourses. Graphical and mathematical models for their computation are given. (Carstea-USGS)
W69-09165

LINDANE ADSORPTION BY LAKE SEDIMENTS,
Wisconsin Univ., Madison. Dept. of Soils.
For primary bibliographic entry see Field 05B.
W69-09167

INVESTIGATIONS OF UNSTEADY WATER FLOW AND RIDGE-LIKE SEDIMENT DISPLACEMENT (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W69-09173

REGIME, THEORY, AND CALCULATION AND MEASUREMENT METHODS OF SEDIMENTATION AND WATER RUNOFF (RUSSIAN),
For primary bibliographic entry see Field 02E.
W69-09174

CALCULATION OF THE AMOUNT OF LITTORALLY DRIFTED SAND,
Latgiproprom Planning Inst.
R. Ya. Knaps.
Transl from Okeanologiya, Akad Nauk, SSSR. Oceanology, Vol 8, No 5, p 680-687, 1968. 8 p, 2 fig, 19 ref.

Descriptors: *Coasts, *Beaches, *Sands, *Sediment transport, *Waves (Water), *Littoral drift, Deposition (Sediments), Currents (Water), Winds, Surf, Ocean currents.
Identifiers: USSR, Wind energy calculations.

Shallow sandy coasts are liable to large-scale littoral drifting, largely as a result of currents caused by storms. Wave action causes roiling at the bottom and the waves themselves carry considerable energy into the inshore area. A large part of the energy is dissipated in the breaker zone and a further part is imparted to currents flowing in directions very different from that of the waves. Wave methods do not offer much promise for calculating littoral drift on sandy coasts. Examples are given which confirm this. The best methods of calculating the movement of drift sand are wind-energy methods, which take account of the combined effects of wind, currents and waves. (Knapp-USGS)
W69-09180

DYNAMICS OF THE BEACH OF THE KILIYA ARM OF THE DANUBE DELTA,
Odessa State Univ. (USSR). Geology of Coast of Seas and Reservoirs.
Yu. D. Shuyskiy.
Transl from Okeanologiya, Akad Nauk, SSSR. Oceanology, Vol 8, No 5, p 687-692, 1968. 6 p, 2 fig, 1 tab, 12 ref.

Descriptors: *Beaches, *Sediment transport, *Deltas, Waves (Water), Currents (Water), Rivers, Streamflow, Alluvium, Aggradation, Geomorphology, Littoral drift.
Identifiers: *USSR, *Danube delta.

The Kiliya arm of the Danube delta is a very youthful geological formation. Its development is very rapid, particularly in those areas where the largest volume of river sediment is deposited and where wave action is light. As a result, as shown by field investigations and an analysis of cartographic material, the northern and southern portions of the delta advance most rapidly, while the central portion is relatively steady. This pattern of development agrees well with earlier schemes of the evolution of the delta. It is also important to shipping interests. Since the distribution of alluvium on the beach depends on the dynamics of the beach deposits, vectors of sediment-moving forces were plotted by the Shishov-Knaps-Pravotorov method. The character of these vectors is quite consistent with the geomorphology of the beach and substantiates the general opinion on the direction of beach drifting. (Knapp-USGS)
W69-09181

STOCHASTIC MODEL FOR THE DEPOSITION OF VARVES IN GLACIAL LAKE BARLOW-OJIBWAY, ONTARIO, CANADA,
Geological Survey of Canada, Ottawa (Ontario).
F. P. Agterberg, and I. Banerjee.
Can J Earth Sci, Vol 6, No 4, Part 1, p 625-651, Aug 1969. 27 p, 15 fig, 5 tab, 49 ref.

Descriptors: *Sedimentation, *Varves, *Statistical models, Stochastic processes, Markov processes, Annual, Beds, Seasonal, Clays, Silts, Sands, Deposition (Sediments), Glaciation, Glacial drift.
Identifiers: Canada, Ontario.

Various methods of time series analysis have been applied to thickness data obtained from eight measured sequences of varves belonging to the Pleistocene glacial Lake Barlow-Ojibway in northern Ontario. Both sedimentological evidence and the results of the statistical analysis support Kuenen's model for varve deposition by turbidity currents. Proximally, individual varves merge with the crossbedded deltaic sands and gravel of eskers. Distally, they change successively from sandy to silty, and then to diamictic facies. Both the silt (summer) and the clay (winter) layers in a varve couplet show an approximately exponential decrease in thickness away from the icefront. This trend is more conspicuous in the silt. The genetic difference between the silt (deposited by turbidity currents) and the clay (deposited out of suspension) is reflected in marked differences in the statistical behavior of their thickness-time series. The thickness variations of both silt and clay layers can be considered as the sum of a gradual, systematic variation (signal) and a random variation (noise). When the effect of the thinning away from the icefront and that of the superimposed noise are eliminated, both the silt and clay residual thickness data satisfy a Markov model of the second order. This model is shown to be related to variations in the rate of retreat of the icefront. Besides the second order Markov process, two weakly-developed short-term cycles have also been detected. (Knapp-USGS)
W69-09238

SEDIMENTATION IN UPPER ARROW LAKE, BRITISH COLUMBIA,
Geological Survey of Canada, Calgary (Alberta).
R. J. Fulton, and M. J. L. T. Pullen.
Can J Earth Sci, Vol 6, No 4, Part 1, p 785-791, Aug 1969. 7 p, 7 fig, 2 ref.

Descriptors: *Sedimentation, *Deltas, *Lakes, *Columbia River, Beds, Deposition (Sediments), Rivers, Sedimentary structures, Turbidity currents.
Identifiers: *Canada, British Columbia, Arrow Lake.

Two rivers, the Columbia and the Incomappleux, empty into the north end of Upper Arrow Lake. The form and the general pattern of sedimentation of the two river deltas were determined by an echo sounder survey. The t hree classical delta sedimentation zones were recognized and observations made on sedimentation in each. Sedimentation in the topset zone is largely channel and overbank deposition similar to that taking place on river floodplains. The bottomset zone receives fine silt and clay carried out to where it can settle under lacustrine conditions. The bulk of the sediment is deposited at the river mouths near the top of the foreset zone. Following initial deposition, the sand and silt dumped at the river mouths is carried into the lake basin by a slow sliding failure of the entire foreset zone. (Knapp-USGS)
W69-09240

RADIOACTIVE METHODS FOR THE QUANTITATIVE DETERMINATION OF COASTAL DRIFT RATE,
Centre d'Etudes Nucleaires de Saclay, Gif-sur-Yvette (France).
For primary bibliographic entry see Field 07B.
W69-09247

THE DETRITAL MINERALOGY OF OCEAN FLOOR SURFACE SEDIMENTS ADJACENT TO THE ANTARCTIC PENINSULA, ANTARCTICA,
Florida State Univ., Tallahassee. Dept. of Oceanography; and Florida State Univ., Tallahassee. Dept. of Geology.
Dennis S. Edwards, and H. Grant Goodell.
Marine Geol, Vol 7, No 3, p 207-234, June 1969. 28 p, 23 fig, 2 tab, 42 ref.

Descriptors: *Sediments, *Antarctic ocean, *Mineralogy, Provenance, Geology, Sediment transport, Ice, Currents (Water).
Identifiers: Antarctic ocean sediments.

The detrital mineralogy of the 62-125 micron size fraction of the marine sediments adjacent to the Antarctic Peninsula delineates 3 sedimentary mineralogical provinces. Western Weddell Sea sediments are dominated by a suite of metamorphic minerals which probably originates along the southern coast of the Weddell Sea. The sediments of the eastern Bellingshausen Sea are composed of a granitic suite originating largely from the rocks of the Andean intrusive, which dominates the geology of the Antarctic Peninsula. The sediments surrounding and to the north of the South Shetland Islands overwhelmingly consist of a volcanic extrusive suite derived from the insular volcanism. Ice rafting is considered the primary mode of transport, although in rare instances deep currents appear to have concentrated heavy minerals into placer or lag deposits. (Knapp-USGS)
W69-09248

SOUTH PACIFIC SEDIMENT DISTRIBUTION,
Lamont-Doherty Geological Observatory, Palisades, N.Y.
M. Ewing, R. Houtz, and J. Ewing.
J Geophys Res, Vol 74, No 10, p 2477-2493, May 15, 1969. 17 p, 16 fig, 29 ref.

Descriptors: *Sediment distribution, *Pacific Ocean, *Seismic studies, *Marine geology, Trenches, Climatic zones, Structural geology, Velocity, Bottom sediments, Water circulation, Buoys, Detritus, Biological properties, Diatoms, Clays, Turbidity currents, Gravity, Antarctic Ocean.
Identifiers: *Sediment isopach map, Sea-floor spreading.

This paper gives sediment distribution, a sediment isopach map, velocity-depth curve, and several seismic profile sections based on seismic profiler data from about 200,000 km of tranverse in the South Pacific. The data reveal in some detail the marginal trench sediments and the sediments of equatorial and subsequatorial zones. Recent sea-floor spreading is indicated by an abrupt thinning of sediments near the crest of the Pacific-Antarctic ridge, with the spreading, it seems, related to possible large-scale vertical movements in Melanesia. The sediment distribution, except near the mid-ocean ridge, in subantarctic waters, seems to depend mainly on the effects of a former northerly location of the polar front and on modern bottom currents. (Gabriel-USGS)
W69-09251

THE CONCENTRATIONS OF LITHIUM, POTASSIUM, RUBIDIUM AND CESIUM IN SOME WESTERN AMERICAN RIVERS AND MARINE SEDIMENTS,
Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 02K.
W69-09281

A CONCEPTUAL MODEL OF KARSTIC EROSION BY GROUNDWATER,
Water Planning for Israel Ltd., Tel Aviv.
S. Mandel.
Hydrol of Fractured Rocks Vol 2, Proc Dubrovnik Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74, p 662-664, 1967. 3 p, 7 ref.

Descriptors: *Erosion, *Karst, *Groundwater basins, *Groundwater movement, Solubility, Channels, Springs, Aquifers, Isotropy, Porosity, Hydrologic properties, Water levels, Limestones, Fissures (Geology), Water types, Water table, Topography.
Identifiers: *Israel, Karstic erosion.

This article is a generalized description of the process of karstic erosion by groundwater mainly based on earlier investigations of the karstic areas in Israel. The author assumes that in saturated zones of calcareous aquifers the process of erosion by solution proceeds at a very slow pace and consists of two correlated phenomena. The phenomena are: (1) solution channels are formed and widened in the vicinity of springs where a strong flow-concentration occurs; and (2) an intricate system of solution channels develops, the dominant characteristic of which is its direction toward the outlet. Direction of groundwater flow is the determining factor in karstic development of calcareous aquifers and the lithological variations, faults and fissures are of secondary importance. A regional system of solution channels can be established only if the general hydrologic conditions remain practically constant during long time intervals. (Gabriel-USGS)
W69-09296

2K. Chemical Processes

CHEMISTRY OF THE SAN JOAQUIN RIVER SYSTEM UNDER BASE FLOW CONDITIONS,
Agricultural Research Service, Fresno, Calif. Ground Water Recharge Field Station.
Harry I. Nightingale, and Jerold J. Behnke.
J Amer Water Works Ass, Vol 61, No 8, p 382-386, Aug 1969. 5 p, 5 fig, 7 ref.

Descriptors: *Water quality, *Streamflow, *California, *Rivers, *Water chemistry, Solutes, Groundwater, Water analysis, Irrigation water, Reservoirs, Springs, Lakes, Precipitation (Atmospheric).
Identifiers: *San Joaquin River.

A water quality survey was made of the San Joaquin River, California, from its origin in the Sierra Nevada to its entry into the east side of the San Joaquin Valley. The base flow of the river system is considerably modified by dams, diversion tunnels, and pipelines for power projects, flood control, and irrigation, all of which alter water quality. From an irrigation standpoint, the quality of all the waters sampled within the San Joaquin River System (with the exception of West Chiquito Creek) was excellent. Although the salt content of the waters was quite low and all the waters were derived from essentially granitic terrain, marked chemical differences did exist between the source lakes and the river tributaries. Mammoth Pool contained more dissolved salts in somewhat different proportions than Huntington and Shaver Lakes. This difference is probably attributable to the fact that some of the higher drainage areas associated with Mammoth Pool contain volcanic and metavolcanic rocks and associated thermal springs, whereas the drainage basins for the 2 other lakes are composed almost exclusively of granitic material. The chemical differences observed in the tributary streams were generally attributed to differences in rock type in the drainage basin, groundwater return flow, or unusual spring discharges. There is approximately an increase in salinity of 6.2 in the water of the San Joaquin River System from its snow origin in the high Sierra Nevada to the eastern edge of the San Joaquin Valley. Most of the salinity increase takes place when the water infiltrates below the ground surface. The displacement of high quality lake waters by tunnels and pipes for hydroelectric power generation has probably proved the chemistry of the river by maintaini firm base flow composed of high quality w stored in the Sierra Nevada lakes. (Knapp-USG
W69-09134

RAPID PHOSPHATE DETERMINATION FLUORIMETRY,
Missouri Univ., Columbia. Dept. of Chemistry; Oak Ridge National Lab., Tenn. Div. of Analyt Chemistry.
For primary bibliographic entry see Field 05A.
W69-09137

ADSORPTION OF NONIONIC SURFACTA BY SOIL MATERIALS,
California Univ., Riverside. Dept. of Soils and P Nutrition.
For primary bibliographic entry see Field 02G.
W69-09141

THE POTENTIOMETRIC ESTIMATION CHLOIDE IN WATER EXTRACTS OF SOILS
Sydney Univ. (Australia). Dept. of Soil Science.
B. G. Davey, and Marion Joy Bembrick.
Soil Sci Soc Amer Proc, Vol 33, No 3, p 385-3 May-June 1969. 3 p, 1 fig, 4 tab, 5 ref.

Descriptors: *Soil water, *Water chemis *Chlorides, *Water analysis, *Electrochemis Electrodes, Water quality, Laboratory tests, Ins mentation, Saline water.
Identifiers: Potentiometric analytical methods.

The thermodynamic equation for the e developed between Ag-AgCl electrodes in a with liquid junction is derived for a complex e trolyte system containing Cl. The equation is te experimentally and a method devised to determ Cl in water extracts of soil. The range of method, 0.00005 M to 0.01 M Cl, is much m sensitive than either the electrometric, cond tometric or the Volhard methods currently use soil analysis. (Knapp-USGS)
W69-09145

METHODOLOGY OF HYDROCHEMICAL VESTIGATIONS (RUSSIAN).
Akademiya Nauk SSSR, Leningrad. Gidr himicheskii Institut.

Gidrochim Mater, Vol 49, Gidrochim Inst, Le grad, 1969. 246 p.

Descriptors: *Water chemistry, *Chemical ana sis, *Reservoirs, Water balance, Sedimentati Rain, Calcium, Carbonates, Trace eleme Radiochemical analysis, Strontium radioisotop Ice, Salt balance, Organic matter, Snowmelt, So
Identifiers: *USSR, Hydrochemical studies water reservoirs.

This volume presents the study of hydrochemi regimes of water reservoirs, mainly based on study of the Otkaznenskiy reservoir located on Kuma River, North Caucasus. Thirty articles in volume discuss sedimentary and salt balanc hydrochemical characteristics, such as dissol gases, organic matter, microelements, and sta and radioactive strontium and other hydrolo properties of water reservoirs. Numerous tab and figures are presented and 363 references cited. (Gabriel-USGS)
W69-09152

GEO-CHEMICAL CLASSIFICATION GROUNDWATER IN THE CARMEL REGION
Hebrew Univ., Jerusalem (Israel). Dept. of Geo gy.
For primary bibliographic entry see Field 07C.
W69-09157

POSSIBLE THERMAL SPRING DEPOSIT IN HE 'ARAD AREA, ISRAEL,
eological Survey of Israel, Jerusalem.
Issar, Y. Eckstein, and R. Bogoch.
rael J Earth-Sci, Vol 18, No 1, p 17-20, 1969. 4 p, ig, 2 tab, 2 ref.

escriptors: *Thermal springs, *Chemical ecipitation, Water chemistry, Mineralogy, oundwater movement, Karst, Carbonate rocks.
entifiers: Israel, 'Arad area.

dolomite-chert breccia body, cemented by a he-atite-goethite-barite-calcite mineral assemblage as found in the 'Arad area, Israel. This assem-age, plus the presence of anomalous quantities of rious elements, particularly molybdenum, and e goethite-hematite relationship, suggest a ther-al mineral spring deposit from a hypogene water urce. (Knapp-USGS)
69-09158

ROUND-WATER FLOW SYSTEMS AND THE RIGIN OF EVAPORITE DEPOSITS,
aho Bureau of Mines and Geology, Moscow.
r primary bibliographic entry see Field 02F.
69-09160

HE GEOCHEMISTRY OF MOLYBDENUM IN HE BLACK SEA,
kademiya Nauk SSSR. Institut Okeanologii.
r primary bibliographic entry see Field 02J.
69-09161

YDROLOGICAL AND HYDROCHEMICAL ONDITIONS IN TIDAL POOLS ON THE EAST URMAN COAST,
eningrad State Univ. (USSR).
I. Zhyubikas.
rans from Okeanologiya, Akad Nauk, SSSR. ceanology, Vol 8, No 5, p 650-657, 1968. 8 p, 5 b, 9 ref.

escriptors: *Water chemistry, *Tidal waters, Ponds, Salinity, Lagoons, Evaporation, Freezing, hosphates, Nitrates, Water temperature, Dis-lved oxygen, Nutrients.
entifiers: *USSR, *Murman Coast, Tidal pools.

he hydrological and hydrochemical conditions in de pools are considerably different from those in e inshore sea area. The greatest variations of ydrochemical conditions and differences from onditions in the sea are found in the supralittoral one. In summer, the temperature in the pools ex-eeds that of the sea, but the salinity is lower espe-ally in the surface layers, while the oxygen con-nt is higher than in the sea. In some supralittoral ools the oxygen concentration may reach 300-00% saturation. However, at low tide at night it ay fall to 13%. The concentration of phosphates nd nitrates in some shallow littoral pools may be 0-30 times greater than in the sea, probably ecause of the action of mussels which inhabit the ools. In autumn hydrochemical differences etween the pools and the sea are small and the ool temperature is below that of the sea, some-mes falling to 5 deg C or even 8 deg C. The salini-in the pools is higher than in the sea, and may ach 130-145 pp+ because of the precipitation of lt during ice formation. In spring the melting of e snow considerably reduces the salinity in the ools. Algal photosynthesis raises the amount of xygen to 200-300% saturation. The concentration nutrients decreases because of their consump-on by algae. (Knapp-USGS)
'69-09179

ISTRIBUTION OF METHANE AND CARBON ONOXIDE BETWEEN THE ATMOSPHERE ND NATURAL WATERS,
aval Research Lab., Washington, D.C.
W. Swinnerton, V. J. Linnenbom, and C. H. heek.
nviron Sci and Technol, Vol 3, No 9, p 836-838, ept 1969. 3 p, 4 fig, 13 ref.

Descriptors: *Methane, *Seawater, *Atmosphere, *Estuaries, *Surveys, Water pollution effects, Path of pollutants, Water quality, Water chemistry, Equilibrium, Thermodynamic behavior, Mass transfer, Aqueous solutions.
Identifiers: *Carbon monoxide, Potomac River, Chesapeake Bay.

Methane and carbon monoxide concentrations in the atmosphere and in natural waters were measured during an oceanographic cruise between Washington, D.C. and Puerto Rico. The concentration of methane was highest in the upper Potomac River and decreased as the ocean was approached. Methane was at equilibrium between the atmosphere and the open ocean, where its average concentration in the atmosphere was 1.24 ppm. Conversely, carbon monoxide concentrations increased in the open ocean relative to the river and bay waters. Equilibrium was not observed for carbon monoxide, and the net transport of this gas appears to be from the water into the atmosphere for all samples analyzed. Atmospheric carbon monoxide concentrations ranged from 0.075 to 0.44 ppm. (Knapp-USGS)
W69-09230

OXYGENATION OF HYDROGEN SULFIDE IN SEAWATER AT CONSTANT SALINITY, TEMPERATURE, AND pH,
Washington Univ., Seattle. Dept. of Oceanography.
Joel D. Cline, and Francis A. Richards.
Environ Sci and Technol, Vol 3, No 9, p 838-843, Sept 1969. 6 p, 7 fig, 2 tab, 20 ref. Grant No GA-64 NSF.

Descriptors: *Oxidation, *Sulfides, *Seawater, *Water chemistry, Sulfates, Sulfur, Sulfur compounds, Biodegradation, Sulfur bacteria, Chemical reactions, Laboratory tests, Hydrogen sulfide.
Identifiers: *Sulfites.

The kinetics of the reaction between sulfides and oxygen in seawater (S= 30.27%) at 9.8 deg C are described. The rate of change of concentrations of total sulfide, oxygen, thiosulfate, sulfite, and pH were determined. Total sulfide, thiosulfate, and sulfite were determined colorimetrically, oxygen chromatographically, and pH electrometrically. The reaction is complex, as indicated by the variety of products, but the temporal course of the reaction generally follows mixed second-order kinetics after the first few hours of the reaction. The apparent rate constants for oxygen and total sulfide were .0015 in the concentration ranges investigated. The major reaction products were thiosulfate and sulfate, with sulfite occurring as an unstable but fairly long-lived intermediate product. The reaction rate decreases as the solid surface area increases. (Knapp-USGS)
W69-09231

DETERMINATION OF PHOSPHATE IN NATURAL WATERS BY ACTIVATION ANALYSIS OF TUNGSTOPHOSPHORIC ACID,
Bureau of Commercial Fisheries, Ann Arbor, Mich. Biological Lab.; and Wayne State Univ., Detroit, Mich. Dept. of Chemistry.
Herbert E. Allen, and Richard B. Hahn.
Environ Sci and Technol, Vol 3, No 9, p 844-848, Sept 1969. 5 p, 5 fig, 2 tab, 8 ref.

Descriptors: *Analytical techniques, *Water analysis, Neutron activation analysis, *Trace elements, *Water chemistry, Chemical reactions, Phosphates.
Identifiers: *Tungsten analysis.

Activation analysis may be used to determine quantitatively traces of phosphate in natural waters. Methods are subject to interference by sulfur and chlorine. If the ratio of phosphorus to sulfur or chlorine is small, as it is in most natural waters, accurate analyses by these methods are difficult to achieve. In the activation analysis method, molybdate and tungsate ions are added to samples containing phosphate ion to form tungstomolybdophosphoric acid. The complex is extracted with 2,6-dimethyl-4-heptanone. After activation of an aliquot of the organic phase the gamma spectrum is essentially that of tungsten-187. The induced activity is proportional to the concentration of phosphate in the sample. A test of the method showed it to give accurate results at concentrations of 4 to at least 200 ppb of phosphorus when an aliquot of 100 microliters was activated. By suitable reagent purification, counting for longer times, and activation of larger aliquots, the detection limit could be lowered several hundredfold. (Knapp-USGS)
W69-09232

THE EFFECT OF CATION EXCHANGE CAPACITY ON THE RETENTION OF DIQUAT AND PARAQUAT BY THREE-LAYER TYPE CLAY MINERALS: 1. ADSORPTION AND RELEASE,
North Carolina State Univ., Raleigh. Dept. of Soil Science.
For primary bibliographic entry see Field 05B.
W69-09249

THE CONCENTRATIONS OF LITHIUM, POTASSIUM, RUBIDIUM AND CESIUM IN SOME WESTERN AMERICAN RIVERS AND MARINE SEDIMENTS,
Scripps Institution of Oceanography, La Jolla, Calif.
C. Sreekumaran, K. C. Pillai, and T. R. Folsom.
Geochim et Cosmochim Acta, Vol 32, No 11, p 1229-1234, Nov 1968. 6 p, 5 tab, 11 ref.

Descriptors: *Water chemistry, *Potassium, *Cesium, *Trace elements, *Rivers, Marine geology, Sediments, Ocean circulation, Water circulation, Water analysis, Sampling, Suspended load, Photometry, Streamflow.
Identifiers: Rare elements in river water, Marine sediments.

Lithium, potassium, rubidium and cesium contents in river water, suspended loads, and bottom sediments were measured by a flame photometric method in samples from three Western American river systems and from marine sediments. Alkali metals in freshwater, alkali metals in river sediments and suspended matter, natural cosium transported by rivers, lithium potassium, rubidium, and cesium found in four marine sediments, and comparative residence of the alkali metals in the ocean are tabulated. (Gabriel-USGS)
W69-09281

ON BICARBONATE DETERMINATION IN NATURAL WATER (ROMANIAN),
Dumitru Ceausescu.
Hidrotehnica, Gosp Apelor, Meteorol, Vol 13, No 3, p 147-149, Mar 1968. 3 p, 1 tab, 12 ref.

Descriptors: *Bicarbonates, *Analytical techniques, *Water chemistry, Acidity, Alkalinity, Indicators, Anion exchange, Cation exchange, Water properties, Acids.
Identifiers: Bicarbonate measurement.

The three most commonly used methods for determination of bicarbonates in water are discussed. These methods are: (1) Titration with a strong acid in the presence of an indicator. However, the carbonates and other hydroxyls are also measured at high pH values; (2) calculation of carbonates from total carbonic acid and pH; Measurement of pH should be very accurate, since only small errors in pH measurement will be appreciably increased in the amount of bicarbonates; and (3) measurement of all cations and all anions except bi carbonates. The difference between cations and anions thus calculated is considered to represent the amount of bicarbonates. The humates are included in bicarbonates by using the last method. A new method is proposed by the author which is simple, rapid, direct and free of interferences. The total content of weak anions is determined by titration with a strong acid in a carbon dioxide-free atmosphere

and in the presence of a mixed indicator. This operation is then followed by a back titration with a strong base to the initial pH of water. The difference between the two titrations represents the amount of bicarbonates. At pH 7 -8.4, the carbonates are also included in this value. (Carstea-USGS)
W69-09289

PROBLEMS OF THE CHEMISTRY OF NATURAL WATERS OF THE SOVIET UNION AND METHODS SUITABLE FOR THEIR ANALYSIS (RUSSIAN).
Akademiya Nauk SSSR, Leningrad. Gidrokhimicheskii Institut.

Stradomskiy, V. B., Editor. Gidrokhimicheskiye Mater, Tom 48, 1968. 180 p, 46 fig, 65 tab, 374 ref.

Descriptors: *Methodology, *Water analysis, *Water chemistry, Water quality, Runoff, River basins, Biochemistry, Ion transport, Reservoirs, Copper, Manganese, Aquifers, Organic matter, Clay minerals, Sludge disposal, Ultraviolet radiation, Suspended load, Potassium, Lakes.
Identifiers: *USSR, Chemistry of Natural waters, Strontium.

A collection of 24 articles by USSR scientists discusses the formation of chemical compounds, the regime of the most common ions, trace elements, biogenetic elements, and organic matter present in the water of lakes, rivers, and reservoirs of the USSR. Several articles are devoted to the methods for the determination of organic content in the natural waters and to the problems of self-purification of natural waters from their organic and inorganic pollution. Russian abstracts of the individual articles are included. (Gabriel-USGS)
W69-09291

TUFF-DEPOSITING WATER TYPES AND CORROSION INTENSITY IN THE NORTHWESTERN PART OF THE DINARIC KARST,
Ivan Gams.
Hydrol of Fractured Rocks Vol 2, Proc Dubrovnik Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74, p 684-689, 1967. 6 p, 4 tab.

Descriptors: *Geochemistry, *Spring waters, *Chemical analysis, Springs, Rivers, Karst, Calcium compounds, Magnesium, Sulfates, Hardness (Water), Lakes, Limestones, Temperature, Silica, Precipitation, Runoff.
Identifiers: *Yugoslavia, Hydrochemical measurments, Tufa deposits.

Water composition and the character of depositions in rivers and springs of the northwestern Dinaric Karst were investigated by recording temperatures, CaO, MgO, and sulfate contents, mean precipitation, runoff, and the volume of rocks in solution. River tuff deposits occur where the tributaries are carrying water rich in MgO or sulfite. Karstic springs in Slavonia rich in CaO or CaO+ MgO and other minerals, are characterized by their tuff deposits. The highest corrosion intensity occurs in the carbonaceous sediments characterized by high runoff and covered with soil. Geological composition, vegetation, soil, precipitation and land use have a strong effect on the degree of corrosion intensity. (Gabriel-USGS)
W69-09299

CHEMICAL DECOMPOSITION OF NITRITE IN SOILS,
Iowa State Univ., Ames. Dept. of Agronomy.
J. M. Bremner, and D. W. Nelson.
Transactions 9th Int Congress of Soil Science, Vol II, Paper 52, p 495-503, 1968. 4 tab, 21 ref.

Descriptors: *Chemical degradation, *Nitrites, *Soil chemistry, Nitrogen, Nitrogen compounds, Nitrogen cycle, Cycling nutrients, Water pollution sources, Soils.
Identifiers: Nitrogen balance, Nitrogen losses (Soils), Nitrite decomposition.

Recent investigations at Iowa State University of the factors affecting chemical decomposition of nitrite in soils and mechanisms of nitrite decomposition are reviewed by the authors. Nitrite decomposition in soils is controlled largely by soil pH and organic matter content, and is due to reaction of nitrite with soil organic matter and to self-decomposition of nitrous acid. Treatment of neutral and acidic soils with nitrite leads to fixation of nitrite-nitrogen and to volatilization of nitrite-nitrogen as nitrogen, nitrogen dioxide, and nitrous oxide. Nitrite-nitrogen lost by nitrite decomposition can be recovered quantitatively as (nitrate plus fixed plus nitrogen plus nitrogen dioxide plus nitrous oxide) minus nitrogen. Phenolic substances in soil organic matter react readily with nitrite under soil conditions to form nitroso-phenols that are decomposed by nitrous acid with formation of nitrogen and nitrogen dioxide. (Keeney-Wis)
W69-09337

CONTROL OF MIXED-SUBSTRATE UTILIZATION IN CONTINUOUS CULTURES OF ESCHERICHIA COLI,
Massachuset ts Inst. of Tech., Cambridge. Dept. of Nutrition and Food Science.
Richard S. Silver, and Richard I. Mateles.
J Bacteriology, Vol 97, No 2, p 535-543, Feb 1969. 6 fig, 2 tab, 40 ref.

Descriptors: *Bacteria, Enzymes, Growth chambers, Organi c compounds, Genetics, Growth rates.
Identifiers: *Escherichia coli, *Chemostat, *Substrate utilization, Escherichia coli B6, beta-galactosidase, Aspartase, Steady-state growth, Glucose, Lactose, L-aspartic acid, Constitutive mutant, Continuous culture.

Authors deal with mechanisms controlling rate of utilization of glucose and lactose by Escherichia coli B6, but the technique could be applied to testing preferential use of any simple mixture of metabolites by pure cultures. By the chemostat principle of continuous growth at steady state (level controllable), the growth rate is set at any level by rate of supply of nutrients. Analyses for growth rate, ratio of metabolites in the washout, and specific enzyme levels and their activity, indicate the control mechanisms of the differential utilization. In the case studied, constitutive mutants for beta-galactosidase emerged; glucose and lactose were both utilized at low growth rates but only glucose at high growth rates. Catabolic repression was the primary mechanism of beta-galactosidase level and thus of lactose utilization. With L-aspartic acid, direct anabolic utilization for protein synthesis and catabolic incorporation occurring simultaneously, allowed uti lization at even low levels of the catabolic enzyme concerned. Mixed populations of microorganisms and of complex mixed metabolites would not allow analyses of specific catabolite repression, but the chemostat principle of controlled steady-state growth might be useful in studies with aquatic bacteria. (McCoy-Wis)
W69-09341

FLOWS AND CYCLES OF MACRO- AND MICRO-ELEMENTS IN A FOREST SOIL AND ITS ENVIRONMENT,
Department of Scientific and Industrial Research, Lower Hutt (New Zealand).
R. B. Miller.
9th Int Congress of Soil Science Transactions, Vol IV, Paper 34, p 323-331, 1968. 3 tab, 5 ref.

Descriptors: Ecosystems, Rainfall, Drainage, Elements (Chemical), Soil properties, Forest soils, Calcium, Phosphorus, Silicon, Manganese.
Identifiers: Soil inputs, Soil outputs, Hutt Valley, New Zealand, Akatarawa hill soil, Soil elements, Macro-elements, Micro-elements, Element cycles, Wellington.

Data on the movements of 19 macro- and micr elements in an ecosystem with hard beec (Nothofagus t runcata) growing on a strong leached acid brown forest soil near Wellingto New Zealand, are presented. Balance sheets whic show the i nputs (leaf-wash, rainwater, cycled, d salt and litter) and outputs (uptake, stored, cycle and leached) are given. Drainage accounted for th following outputs (kilogram/hectare/year): Calc um, 26; magnesium, 22; potassium, 6; sodium, 7 phosphorus, 0.2; nitrogen, 2.4; sulfur, 8; chloren 134; silicon, 49; aluminum, 1.0; barium, 0.02 chromium, 0.001; copper, 0.05; iron, 0.35; ma ganese, 0.001; molybdenum, 0.0015; nickel, 0.00 strontium, 0.32; titanium, 0.015. Calcium was typ cal of many of the elements, the amounts from th atmosphere being sufficient to cover the amou immobilized in the growing trees, and a high pr portion of the pool in the rooting zone bei required for the annual cycle. A large amount silica was cycled in the trees (200 kilograms/he tare/year) and a large amount released to th drainage system (100 kilograms/hectare/year (Keeney-Wis)
W69-09343

MASS SPECTROMETRIC MEASUREMENT O NITROGEN-15 ENRICHMENT IN NITROGE OBTAINED BY DUMAS COMBUSTION,
National Research Council of Canada, Halifa (Nova Scotia). Atlantic Regional Lab.
D. Desaty, R. McGrath, and L. C. Vining.
Analytical Biochemistry, Vol 29, No 1, p 22-3 Apr 1969. 4 tab, 9 ref.

Descriptors: *Chemical analysis, *Nitrogen.
Identifiers: *Mass spectrometry, *Nitrogen-1 *Nitrogen enrichment, *Dumas procedur Nitrogen analyzer.

The authors describe a rapid, accurate, Duma method for determining nitrogen-15 enrichmen from 0.37 to 100%. Compounds with only on nitrogen atom exhibit random pairing, bu equilibration is incomplete in compounds with tw or more variously bonded (nitrogen-nitrogen, o ygen-nitrogen, and carbon-nitrogen) nitroge atoms. Failure to equilibrate is presumed to resu from differences in bond energy between nitroge and adjacent atoms. Modifications of the Colema Model 29 nitrogen analyzer for use in collectin samples for nitrogen-15 measurement a described. (Keeney-Wis)
W69-09344

STEADY STATE STUDIES OF NITRIFICATIO IN SOIL: THEORETICAL CONSIDERATIONS,
California Univ., Berkeley. Dept. of Soils and Pla Nutrition.
A. Douglas McLaren.
Soil Science Socity of Amer Proc, Vol 33, No 2, 273-276, Mar-Apr 1969. 1 fig, 17 ref.

Descriptors: *Equilibrium, *Nitrification, *So chemistry, *Theoretical analysis, Nitrogen cycl Nitrates, Nitrites, Ammonium.
Identifiers: Miscible displacement, Clynamics.

The author states that since, in nature, ammoni produced by microbial action or added as fertiliz is subjected to downward translocation, therefor continuous flow laboratory columns would be mo nearly representative of field conditions than repe fusion methods. Equations are set up for consecu tive reactions in an idealized soil column an solved for concentrations of metabolites as fun tions of time and depth within the column unde steady state conditions. The reactions of ammon um ion to nitrite ion to nitrate ion were so e pressed for columns with maximum numbers nitrifying organisms. (Keeney-Wis)
W69-09345

DETERMINATION OF SOIL CATIO EXCHANGE CAPACITY BY A SIMPL SEMIMICRO TECHNIQUE,
Wisconsin Univ., Madison. Dept. of Soils.

). R. Keeney, and J. M. Bremner.
oil Science, Vol 107, No 5, p 334-336, 1969. 1
ab, 11 ref.

Descriptors: *Soil chemistry, *Cation exchange, Chemical analysis, Ammonium compounds.
Identifiers: *Cation exchange capacity, Ammonium retention, Ammonium fixation.

The authors describe a cation exchange capacity (CEC) method which does not involve removal of he excess saturating cation by exhaustive washing rocedures, thus eliminating sources of error in this etermination due to salt retention, loss of the ndex cation by hydrolysis, or sample dispersion. In his method, the soil sample is treated with amonium acetate (1 Normal, pH 7), the ammonium cetate removed by leaching with an ammonium-itrate solution, and the treated sample analyzed irectly for ammonium-nitrogen by steam distillaon with sodium chloride (2 Moles) and magnesim oxide after partial removal of ammonium itrate by washing with a small amount of sopropanol. The amount of nitrate-nitrogen in the ample is subsequently determined by steam distilation of the sample with Devarda alloy, and the mount of salt retained in the sample corrected by se of the nitrate-nitrogen value. The method is mple and precise, is not subject to obvious errors f many other CEC procedures, and gives results milar to accepted CEC methods involving use of mmonium as the index cation. (Keeney-Wis)
V69-09346

ADIATION AS A TECHNIQUE IN SOIL IOLOGY AND BIOCHEMISTRY,
alifornia Univ., Davis. Coll. of Agriculture.
. D. McLaren.
oil Biology and Biochemistry, Vol 1, No 1, p 63-3, 1969. 1 tab, 59 ref.

Descriptors: *Soil chemistry, *Irradiation, Soils, Microbiology, Nutrients.
Identifiers: *Soil biology, *Soil biochemistry, terilization.

A review of the utilization of ionizing radiation in oil is presented. Included are observations on the ifferences in sensi tivities of various genera of soil icroorganisms to radiation sterilization and on esidual enzyme activities in sterile soil. As a rule, he larger the microbe the smaller is the minimum ose required. Generally, microorganisms and enymes are killed or inactivated as exponential funcons of dose of radiation, but the dose requirements depend upon the soil t ype, soil moisture and enus of organism. Irradiation induces release of mall amounts of manganese, ammonium, soluble arbon, organic nitrogen, phosphorus, etc. from oil microbes and, to a lesser extent, from humus. The nutrients released can stimulate plant growth n radiation sterilized soil; no toxicity has been oted following soil irradiation. Cells no longer ble to proliferate after irradiation may still be iochemically active, e.g. in respiration and nitrifiation. Irradiated soil is useful for studies of plant-oil-microbe relationships in cases where residues rom chemical sterilizing reagents of toxic products rom steam sterilization treatment are to be voided. (Keeney-Wis)
V69-09350

ESPONSE OF CHEMOAUTOTROPHIC ITRIFIERS TO FOREST CUTTING,
ale Univ., New Haven, Conn.; and Dartmouth oll., Hanover, N.H.
V. H. Smith, F. H. Bormann, and G. E. Likens.
oil Science, Vol 106, No 6, p 471-473, 1968. 1
ab, 10 ref.

Descriptors: *Nitrogen cycle, *Nitrification, Forest management, Ecosystems, Leaching, Runoff, New Hampshire, Watersheds (Basins), Soil acteria.
Identifiers: *Chemoautotrophs, *Forest cutting, litrosomonas, Nitrobacter, Hubbard Brook Experimental Forest, New Hampshire, Nutrient emoval.

Soils from cutover and undisturbed forest ecosystems in the Hubbard Brook Experimental Forest, New Hampshire, were analyzed for populations of the Nitrosomonas and Nitrobacter groups by the most probably number method. Although the soils in both watersheds were extremely acid (pH 4), they had relatively large populations of Nitrosomonas (9,700-1,850,000 cells/gram). The cutover watershed contained significantly higher numbers of both groups of nitrifiers than did the control watershed. Previous investigations in 1966 had shown that the cutover watershed had a large net release of nitrogen (57 kilograms/hectare) while the control had a net gain of 4.5 kilograms/hectare. The authors felt that the initial increase in chemautotrophic activity was closely related to factors, other than the microclimate, directly correlated with the removal of vegetation. (Keeney-Wis)
W69-09351

2L. Estuaries

A NUMERICAL MODEL OF THE SALINITY DISTRIBUTION IN UPPER CHESAPEAKE BAY,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
William Boicourt.
Chesapeake Bay Inst Tech Rep No 54, May 1969. 59 p, 18 fig, 28 ref, 3 append. ONR Contract No Nonr 4010 (11). Project No NR083-016.

Descriptors: *Estuaries, *Mathematical models, *Salinity, *Flow, Mixing, Diffusion, Turbulence, Water circulation, Currents (Water), Tides, Computer programs, Input-outputanalysis.
Identifiers: *Chesapeake Bay, Susquehanna River.

Upper Chesapeake Bay can be modeled as a one-dimensional estuary to predict the salinity distribution for a given fresh water inflow from the Susquehanna River. The one-dimensionality implies that salinity values are averages taken over the cross section of the estuary and that variables are related only to time and position along a longitudinal axis. The model presented in this study is based on a salt continuity equation in which the seaward salt advection is balanced by turbulent diffusion toward the head of the Bay. Since the interest is in the effects of net non-tidal circulation, the governing equation has been averaged over the tidal cycle. In final form, it is a linear, parabolic partial differential equation with variable coefficients. One years's salinity data were used to determine the functional dependence of the coefficients on the fresh water inflow. The boundary value at the head of the estuary is held fixed, while the seaward boundary value is allowed to vary with time. A separate predictor model relates this value to the flow of the Susquehanna. The computer program listing is included. (Knapp-USGS)
W69-09146

APPRAISAL OF RESEARCH ON DESERT COASTAL ZONES,
Arizona Univ., Tucson; and Army Natick Labs., Mass.
Joseph F. Schreiber, Jr.
IN W.G. McGinnies, B.J. Goldman, and Patricia Paylore, eds., Deserts of the World, an Appraisal of Research into their Physical and Biological Environments, p 647-724, University of Arizona Press, Tucson, 1968. 78 p, 1 fig, 2 tab, 530 ref.

Descriptors: *Deserts, *Coasts, *Synoptic analysis, Arid lands, Arid climates, Semiarid climates, Beach erosion, Beaches, Deltas, Dunes, Geomorphology, Sands, Shore protection, Shoreline cover, Wind erosion, Bibliographies, Coastal marshes, Ocean currents, Swamps, Coastal engineering, Harbors, Intertidal area, Littoral, Surf, Tides, Estuarine environment, Marine geology, Ocean currents, Ocean waves, Oceanography, Gulf.
Identifiers: Australian coastal deserts, Mexican coastal deserts, Peruvian coastal deserts, Chilean coastal deserts, Saudi Arabia, Patagonian coastal deserts, African coastal deserts, Arabian Sea, Persian Gulf, Red Sea.

This study is an inventory and evaluation of literature and research regarding those areas of the Earth where major deserts meet the sea. The following factors are included: nearshore bottom conditions; tides and currents; surf, breakers, and waves; beaches; shore and nearshore erosion and sedimentation; coastal swamps and marshes; and coastal structures and other culture features. An introduction, survey of information available, and review of current research and suggested research is presented for each of the 14 coastal deserts treated. The most important authorities, libraries, data centers and sources of published information are discussed. The evaluation includes discussion of outstanding contributions, significant theories and contributions, nature of the most useful study, model studies and deficiencies in knowledge. It is recommended that an organized, systematic, well-supported research program is essential to achieve the objective of a basic understanding of the physical, biological, and cultural factors, individually and collectively, that combine to give the coastal desert zone its distinctive characteristics. Specific research areas for future work are detailed. (See W69-09206). (Sherbrooke-Ariz)
W69-09209

EXTRAORDINARY TIDAL CURRENTS NEAR ST. KILDA,
National Inst. of Oceanography, Wormley (England).
D. E. Cartwright.
Nature, Vol 223, No 5209, p 928-930, Aug 30, 1969. 3 p, 3 fig, 2 tab.

Descriptors: *Currents (Water), *Tides, Tidal effects, Diurnal, Ocean currents, Continental shelf, Water level fluctuations.
Identifiers: United Kingdom, Hebrides, St. Kilda.

Recent current and water level measurements in the Hebrides, UK show that although the vertical tide at St. Kilda has a normal diurnal inequality, the diurnal tidal currents are unusually strong. The spectral analysis evidence points to a nondivergent tidally induced continental shelf wave. (Knapp-USGS)
W69-09233

RADIOACTIVE METHODS FOR THE QUANTITATIVE DETERMINATION OF COASTAL DRIFT RATE,
Centre d'Etudes Nucleaires de Saclay, Gif-sur-Yvette (France).
For primary bibliographic entry see Field 07B.
W69-09247

A NOTE ON THE EFFECT OF DISPERSION ON MEAN CURRENT MEASUREMENTS,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
Akira Okubo.
Chesapeake Bay Inst Tech Rep No 55, June 1969. 14 p, 6 fig, 9 ref, append. AT (30-1) 3109 AEC NYO-3109-44 ONR.

Descriptors: *Estuaries, *Currents (Water), *Current meters, *Statistical methods, *Tracers, Tracking techniques, Dye releases, Diffusion, Turbulence.
Identifiers: Current measuring errors.

The difficulty with drift type current measuring devices is that they move in a random way with respect to the mean current. Thus, when a small number of current followers are used, the values of mean current derived from the observations do not necessarily represent the true values which could be approximated more clearly by a large number of drift devices. In light of the present knowledge of oceanic diffusion, statistical errors associated with current measurement of this type may be estimated. These errors are generally of the order of 1 cm/sec, but may, in some cases, be as large as 10 cm/sec. The statistical problem can be solved partially by the use of tracers; dye tracers have proved to be quite useful in measuring the mean current as

well as in studying diffusion. One must, however, be careful not to interpret the movement of dye patches simply as indicative of the mean current. A knowledge of turbulent diffusion is also needed. (Knapp-USGS)
W69-09252

MAXIMUM ENTROPY MIXING IN ESTUARIES,
Manhattan Coll., Bronx, N.Y.
Dominic M. DiToro.
J Hydraul Div ASCE, Vol 95, No HY4, p 1247-1271, July 1969. 25 p, 8 tab, 37 ref.

Descriptors: *Estuarine environment, *Markov processes, *Entropy, *Salinity, Optimization, Mathematical models, Delaware River, Mixing, Tidal waters, Numerical analysis.

The application of different mathematical models and estuarine theories of maximum entropy mixing for optimum estuarine environment were reviewed. The theory of tidal mixing proposed by Predy formed the basis for the model of maximum entropy mixing which was developed in terms of Markov chains. Three conservation laws which any physically reasonable mixing process must satisfy were related to the properties of a Markov chain The estimate of the appropriate mixing matrix was based on maximum entropy of statistical mechanics and information theory. A numerical technique was employed for solving the resulting simultaneous transcendental equations. A comparison of the equilibrium salinity intrusion data from the Delaware River Model and the theoretical predictions based on the maximum entropy estimate of the mixing process indicated that the theory of entropy mixing is a sound and practical solution to the problem of characterizing the mixing process in an estuary. (Thiuri-Cornell)
W69-09357

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

FRESHWATER AND METHODS FOR ITS PRODUCTION FROM SEAWATER,
Leningrad Higher School of Marine Engineering (USSR).
V. I. Vul'fson.
Oceanology, Vol 7, No 1, p 1-10, 1967. 10 p, 8 fig, 2 tab, 21 ref. Trans by Amer Geophysical Union from Okeanologiya, Akad Nauk, SSSR, Vol 7, No 2.

Descriptors: *Desalination processes, *Water resources development, Saline water, Freshwat er, Seawater, Semipermeable membranes, Solvent extractions, Freeze drying, Resins, Dialysis, Ion exchange, Reverse osmosis, Evaporation.
Identifiers: *USSR, *Methods for water desalination.

The freshwater is unevenly distributed on the earth's surface. Moreover, the geographical distribution of freshwater does not coincide with the present water requirements. The water supply can be improved by redistribution of water resources by more rational utilization and re-use of water and by desalinization of seawater. In the Soviet Union, the water desalinization is very important for the areas of Azerbaijan, Turkmenia, and Kazakstan. The production of freshwater from seawater at a low cost is the most important problem facing the water managers. This paper briefly discusses the advantages and disadvantages of the common desalinization methods. These methods are: Evaporation, freezing, electric ion-exchange, ion-exchange, reverse osmosis, extraction, use of ion-active resins, destruction of the aqueous solution structure, and biological method. The evaporation method is the most widely used for desalinization purposes. All methods used require energy and, therefore, cheap sources of energy is of utmost importance to maintain the cost of the desalinization process as low as possible. The use of atomic power seems to be the best future source of energy for desalinization. (Carstea-USGS)
W69-09203

FUTURE USE OF DESERT SEACOASTS,
Peveril Meigs.
IN W.G. McGinnies and B.J. Goldman, eds., Arid Lands in Perspective, p 101-118, University of Arizona Press, Tucson, 1969. 18 p, 8 fig, 35 ref.

Descriptors: *Forecasting, *Deserts, *Coasts, *Water utilization, Future planning (Projected), Economic prediction, Cloud seeding, Fog, Desalination, Desalination plants, Agriculture, Competting uses, Domestic water, Recreation demand, Groundwater, Arid zones, A rid climates, Hydroponics, Trenches, Water conservation, Water consumption, Water reuse, Cisterns.

The forecast for the next 10 or 20 yr. is that there will be no natural permanent change in rainfall, river flow, or groundwater level, and that men will not by artificial means increase rainfall in desert seacoasts. Desalinated seawater will be used more and more for domestic water supplies and for manufacturing, but not for field farming. Various types of desalination are reviewed as are studies on condensation of fog. Cities and towns will continue to grow more than rural areas; suburbs, dairying, and truck farming will increase just outside the cities. Recreation and retirement facilities will grow, within the sphere of cities and far from cities. Agriculture will grow sporadically in places where men develop groundwater and river water previously unused, and locally, surface water. Hydroponics will be increasingly used where water is expensive. Improved utilization of water resources for agriculture will include groundwater pumping, trench farming, crops with lower water use, water reuse, and deep cisterns. Growth of mining, sea industries, recreation, science and conservation are also expected in desert seacoasts. (See W69-09210). (Sherbrooke-Ariz)
W69-09211

A DESERT SEACOAST PROJECT AND ITS FUTURE,
Arizona Univ., Tucson. Environmental Research Lab.
Carl H. Hodges.
IN W.G. McGinnies and B.J. Goldman, eds., Arid Lands in Perspective, p 119-126, University of Arizona Press, Tucson, 1969. 8 p, 4 fig, 5 ref.

Descriptors: *Desalination plants, *Coasts, Deserts, Arid zones, By-products, Desalination apparatus, Desalination processes, Condensers, Pilot plants, Greenhouses, Water utilization efficiency, Crop production, Transpiration, Powerplants.
Identifiers: *Water-power-food complex.

This paper reports on a joint project of the University of Sonora and the University of Arizona t o develop an integrated facility for the production of power, water and food for coastal desert areas. A pilot plant was constructed at Puerto Penasco, Mexico. Plans for a solar distribution plant were changed when it was found that almost all coastal communities have waste thermal energy from power plants. The pilot plant utilizes waste thermal energy from the diesel-electric plant that generates the power for the experimental complex. The desalination plant is a 6,000 q./day humidification type distillation unit. 160 deg F seawater is supplied by the power plant, while 78 deg F seawater is taken from a saltwater well. Food production is accomplised in inflated plastic greenhouses, which maintain 100 per cent relative humidity. These units are kept cool by circulation of the air through a seawater spray. During winter months there is a net production of freshwater in the greenhouses due to condensation. Larger units, 64,000 q./day, are presently under evaluation and it is expected that units of this size will be utilized in some ar of the world within the next few years. (See W 09210). (Sherbrooke-Ariz)
W69-09212

IMPORT ALTERNATIVES,
Oak Ridge National Lab., Tenn.
Gale Young.
IN W.G. McGinnies and B.J. Goldman, Eds., A Lands in Perspective, p 382-397, University Arizona Press, Tucson, 1969. 16 p, 14 fig, 53 ref

Descriptors: *Water utilization, *Water conse tion, Arid lands, Water transfers, Hydrologic cy River flow, Acreage, Cultivated lands, Agricult Waste water treatment, Sewage disposal, Wa water (Pollution), Sewage treatment, Water re Waste water reclamation, Cost analysis, Cost co parisons, Membrane processes, Desalinat processes, Evaporators, Water utilization, Run Watershed management, Vegetation, Fog, Cl seeding.
Identifiers: Granges Valley.

This paper reviews some water management al natives to large-scale transfers of water. Data the world water cycle and on average river flow some of the important rivers of the world presented. Arid areas are treated in historical p spective, and their land area is compared to tha agricultural areas. The water development pot tial of the Ganges Valley is pointed out. Utilizat of rivers to carry garbage and waste to the sea is lated to water pollution and water short problems. Diagrams, formuli and water costs large city water systems with recycling of water presented. Several types of desalination discussed and costs are computed for these various combined treatment-desalination syste for large cities. Problems of efficient use desalinated water in seashore agriculture are c sidered. Methods are discussed of increas precipitation by seeding clouds and 'catching' and of increasing runoff by alteration of the vege tion. (See W69-09210). (Sherbrooke-Ariz)
W69-09220

AN ECONOMIC AND ENGINEERING ANAL SIS OF THE ELECTRODIALYSIS PROCESS,
Bechtel Corp., San Francisco, Calif.
J. Winston Porter, and S. Cherney.
OSW R and D Report No 470, 1969. 142 p. O 14-01-0001-1704.

Descriptors: *Desalination, *Electrodialy *Membrane Processes Cost Optimization, Pl Design.
Identifiers: *Desalination Apparatus, *El trochemistry, Computer algorithm, Economics.

A parametric engineering and economic analysis the electrodialysis process was performed in wh water costs were examined for demineralizing th reference brackish waters in plant sizes of 1, 10 a 50 mgd capacity. Capital costs and operat parameters were first based on detailed pl designs using state-of-the-art technology, and co puterized process and plant design calculati provided specifications for producing lowest-c water in each case. Additional plant designs a cost estimates were developed to evaluate the fect of projected technological developments demineralized water costs. (Mintz - Office of Sal Water).
W69-09226

DISPOSAL OF BRINE EFFLUENTS FROM LAND DESALTING PLANTS: REVIEW A BIBLIOGRAPHY,
Bureau of Reclamation, Washington, D.C.
For primary bibliographic entry see Field 05E.
W69-09353

SPRAY SYSTEMS - A METHOD OF INCRE ING WATER EVAPORATION RATES

ACILITATE BRINE DISPOSAL FROM ESALTING PLANTS,
ireau of Reclamation, Washington, D.C.
or primary bibliographic entry see Field 05E.
69-09354

B. Water Yield Improvement

ESERTS OF THE WORLD, AN APPRAISAL F RESEARCH INTO THEIR PHYSICAL AND OLOGICAL ENVIRONMENTS.
izona Univ., Tucson. Inst. of Arid Lands esearch.

ne University of Arizona Press, Tucson, 1968. 8 p. Editors: William G. McGinnies, Brian J. oldman, and Patricia Paylore.

escriptors: *Arid lands, *Deserts, *Environment, vironmental effects, *Arid climates, Semiarid mates, Tropical regions, *Reviews, Synoptic alysis, *Bibliographies.

ternational in its scope and treatment, this lume presents for the first time a comprehensive, aluative inventory of the state of current owledge and research dealing with the world's sert environments. Included in the composite udy are works by recognized authorities in seven pical fields covering physical features, vegeta-n, animal life, weather and climate, coastal nes, and groundwater research. Based upon a itical review of available scientific literature, in-vidual contributors set out to ascertain notable ficiencies, and review and evaluate existing in-rmation within the scope of their respective lds. The comprehensive collection and integra-n of material is a contribution of major propor-ns to the general cognizance of dry-land studies. ne authors have illuminated the need for future celeration in synthesis and arid-land research. A nited States contribution to the International drological Decade. (See also W69-09207 thru 69-09209).
69-09206

PPRAISAL OF RESEARCH ON WEATHER ND CLIMATE OF DESERT ENVIRONMENTS,
izona Univ., Tucson; and Army Natick L abs., ass.
r primary bibliographic entry see Field 02B.
69-09207

PPRAISAL OF RESEARCH ON SURFACE ATERIALS OF DESERT ENVIRONMENTS,
izona Univ., Tucson; and Army Natick Labs., ass.
r primary bibliographic entry see Field 02G.
69-09208

PPRAISAL OF RESEARCH ON DESERT OASTAL ZONES,
izona Univ., Tucson; and Army Natick Labs., ass.
r primary bibliographic entry see Field 02L.
69-09209

RID LANDS IN PERSPECTIVE, (Including AAS Papers on Water Importation Into Arid nds).
nerican Association for the Advancement of ience, Washington, D.C.

e University of Arizona Press, Tucson, Arizona, 69. 421 p. William G. McGinnies, and Bram J. oldman, Editors.

escriptors: *Arid lands, *Deserts, Arid climates, miarid climates, *Water utilization, *Water nsfer, *Reviews, Bibliographies.

is book was compiled under the leadership of the lvisory Committee for Arid Lands Research of e University of Arizona and the Committee on Arid Lands of the American Association for the Advancement of Science. The 31 articles in this publication represent the combined efforts of many people with varied orientations to summarize aspects of current research and knowledge relevant for the multitudes attempting to inhabit Earth's warm arid areas, noted for their imbalance of natural resources, one of the most important of which is water. (See also W69-09211 thru W69-09225).
W69-09210

LARGE-SCALE TRANSFERS OF WATER AND ALTERNATIVES,
Arizona Univ., Tucson. Water Resources Center.
Sol Resnick.
IN W.G. McGinnies and B.J. Goldman, Eds., Arid Lands in Perspective, p 418-421, University of Arizona Press, Tucson, 1969. 4 p.

Descriptors: *Arizona, *Water conservation, Arid lands, Deserts, Desalination, Water transfers, Interbasin transfer, Import, Reservoir evaporation, Evaporation control, Alcohols, Artificial recharge, Waste water disposal, Water reuse, Surface runoff, Water harvesting, Small watersheds, Sodium chloride, Sewage treatment, Electric power plants, Irrigation-efficiency, Economic feasibility.
Identifiers: Styrofoam.

The author reports on water related research programs at the University of Arizona that pertain to the development of alternatives to large-scale water imports. Evaporation suppression studies concluded that use of long-chain fatty alcohols on less than one-acre ponds was not economically feasible. Use of floating styrofoam rafts was much more encouraging, $65 per acre-foot of water saved (approx. equal costs of large scale water transfers). Experimental use of Tucson Gas and Electric Company's effluent for artificial groundwater recharge is reported on. Two approaches toward increasing the runoff from desert watersheds are being studied. One involves rather limited catchments to provide stock or municipal supplies and includes a storage scheme, while the other is for a much broader treatment of the desert watershed with rock salt. Reuse of waste water is being investigated at the Tucson Sewage Treatment Plant. In Puerto Penasco, Mexico, research has shown that it may be possible to produce electricity, freshwater and food economically as a package unit in arid coastal zones. Other important alternatives studied centered on increasing irrigation efficiencies, which are presently estimated at only 50 per cent. Reasons why large-scale water transfers may become economically feasible in the future and reasons for continuing studies into that feasibility and alternatives to water transfer are outlined. (See W69-09210). (Sherbrooke-Ariz)
W69-09225

AIRBORNE INFRARED RADIOMETER INVESTIGATION OF WATER SURFACE TEMPERATURE WITH AND WITHOUT AN EVAPORATION-RETARDING MONOMELECULAR LAYER,
Colorado State Univ, Fort Collins. Dept. of Atmospheric Science; and Wave Propagation Lab., Boulder, Colo.
R. L. Grossman, B. R. Bean, and W. E. Marlatt.
J Geophys Res, Vol 74, No 10, p 2471-2476, May 15, 1969. 6 p, 5 fig, 2 tab, 6 ref.

Descriptors: *Remote sensing, *Surveys, *Infrared radiation, *Monomolecular films, *Oklahoma, Evaporation, Summer, Instrumentation, Alcohols, Statistical methods, Humidity, Computer programs, Winds, Air-water interfaces, Evaporation control, Water temperature.
Identifiers: *Infrared radiometer measurement, *Lake Hefner, Okla.

Water surface temperature measurements of Lake Hefner, Oklahoma were made August 17-30, 1966 by using an airborne infrared radiometer and the results so obtained were compared with those obtained by a boat radiometer and a floating thermistor. The study shows an average duirnal variation of about 1 deg C for late summer conditions. The lake surface was 0.4 deg to 0.9 deg C cooler than the water about 1 cm below the surface because of cooling by evaporation. Applications of an evaporation-reducing monomolecular film reversed the observed temperature under the monomolecular layer was 0.3 deg C warmer than in the surrounding open water. The comparison of the observations made by the aircraft boat, and floating radiometers shows the reliability of airborn temperature surveys. (Gabriel-USGS)
W69-09253

PREDICTION OF WATER YIELD IN HIGH MOUNTAIN WATERSHEDS BASED ON PHYSIOGRAPHY,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
Robert W. Julian, Vujica Yevjevich, and Hubert J. Morel-Seytoux.
Colo State Univ Hydrol Paper No 22, Aug 1967. 21 p, 9 f ig, 4 tab, 28 ref.

Descriptors: *Rainfall-runoff relationships, *Streamflow forecasting, *Runoff forecasting, *Statistical methods, *Topography, Statistical models, Model studies, Water yield, Water resources development, Weather modification, Colorado River Basin.
Identifiers: *Watershed analysis, Watershed models, Physiography.

A statistical method is presented that permits the estimation of yield of high mountain watersheds in terms of physiographic characteristics evaluated from maps. The method is advantageous because it does not require the knowledge of the climatic or hydrologic characteristics of the basin or of the region. The method is, however, limited to regions of reasonable climatic and hydrologic homogeneity. The applicability of the method is illustrated for several regions in the Upper Colorado River Basin. A coefficient of determination as high as 77% is obtained in the best case. In the worst result the coefficient falls below 50%. The estimate of specific yield is valuable for many applications. It provides, in particular, a means of deciding upon the suitability of basins to weather modification programs. (Knapp-USGS)
W69-09293

3C. Use of Water of Impaired Quality

FUTURE USE OF DESERT SEACOASTS,
For primary bibliographic entry see Field 03A.
W69-09211

A WATER-QUALITY HIERARCHY FOR ARID LANDS,
North Carolina Univ., Chapel Hill. School Public Health.
For primary bibliographic entry see Field 05D.
W69-09213

WARM-WATER IRRIGATION: AN ANSWER TO THERMAL POLLUTION,
SCIENCE, Washington, D.C.
For primary bibliographic entry see Field 05B.
W69-09301

MUSKEGON COUNTY PLAN FOR MANAGING WASTE WATER.
Muskegon County Board of Supervisors; and Bauer Engineering, Inc., Chicago, Ill.
For primary bibliographic entry see Field 05D.
W69-09331

3E. Conservation in Industry

WATER REQUIREMENTS AND USES IN WYOMING MINERAL INDUSTRIES,
Bureau of Mines, Denver, Colo. Dept. of Engineering.
For primary bibliographic entry see Field 06D.
W69-09294

PERCEPTION OF CHOICE AND FACTORS AFFECTING INDUSTRIAL WATER SUPPLY DECISIONS IN NORTHEASTERN ILLINOIS,
Chicago Univ., Ill. Dept. of Geography.
Shue Tuck Wong.
Department of Geography Research Paper No 117, University of Chicago, 1969. 93 p, 37 ref, 93 p.

Descriptors: *Decision making, *Water management (Applied), *Industrial use (Water), *Industrial plants, Water supply, Water shortage, Water conservation, Water rates, Water sources, Economic efficiency, Legal aspects, Recirculated water.
Identifiers: Northeastern Illinois Metropolitan Area, Cook County.

Intake of water by similar industrial plants often varies even when conditions of quality and quantity are stable. The purpose of this study is to explore the possible role which perception of the range of adjustments plays in industrial water supply management. The range of adjustments includes: recycling, re-use, elimination of losses, substitution process changes. A decision by an industrial manager as to what adjustments or combination of adjustments to adopt varies, depending on conditions under which the choice is exercised. These may include: (1) Type of industry, (2) age of plant, (3) temporal lapse, (4) size of plant, (5) sources of water supply, (6) experience of a water shortage, (7) price of public water, (8) increase in the cost of water, (9) cost of treatment, (10) need for quality control, (11) rates of repayment investment in conservation equipment, (12) legal restrictions, (13) experience of manager, and (14) sources of information. Through use of questionnaires and analysis of 35 case studies, some patterns of perception and choice of adjustments were found. The conditions under which choice adjustments are exercised, are primarily economic-technologic and partly that of water supply and temporal lapse, all affected by social guides. There was also a correlation between perception and adoption, that is, those managers who perceived became adopters and those who adopt also perceive a wider range of adjustments than those who do not. (Marriott-Chicago)
W69-09322

3F. Conservation in Agriculture

CONSERVATION OF WOODLAND AREAS.
For primary bibliographic entry see Field 06E.
W69-09081

OPTIMIZATION OF WATER PLANNING USING A SPECIAL PURPOSE COMPUTER,
Technion - Israel Inst. of Tech., Haifa. Dept. of Agricultural Engineering; and Elbit Computers Ltd., Haifa (Israel).
For primary bibliographic entry see Field 06A.
W69-09367

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

COMMONWEALTH V GORHAM (SUIT TO COMPEL LAND OWNER TO REINSTATE DRAINAGE SYSTEM).

56 Lackawanna Jurist 189-194 (Pa CP 1955).

Descriptors: *Pennsylvania, *Surface drainage, *Highways, *Obstruction to flow, Roads, Surface water, Surface runoff, Natural streams, Watercourses (Legal), Drainage systems, Subsurface drainage, Drainage water, Repulsion (Legal aspects), Pipes, Ditches, Watersheds (Basins), Legal aspects, Judicial decisions.
Identifiers: Injunction (Mandatory).

Defendants bought land across which ran a natural drainage ditch. This ditch had conducted waters, f lowing across and under an adjacent highway, to a creek in the back of defendants' property. In building a home on the property defendants filled in a catch basin and said drainage ditch causing water to collect under and on the other side of the highway. The state sought an injunction to force defendants to replace the drainage ditch so as to allow the drainage of surface waters. In fi nding for the plaintiff the court held that the arbitrary filling in of a ditch, which had carried off the waters of a hi ghway for 60 or 70 years, without providing for proper drainage of the water from the highway, constituted a continuing nuisance which would be restrained and defendants were ordered to provide for such drainage. The court also took note of the fact that proper drainage could have been provided by the installation of a subterranean pipe from the catch basin to any point across defendants' land. (Logan-Fla)
W69-09069

INVESTIGATION OF HIGH AND LOW LEVELS.

NH Rev Stat Ann secs 482:1, 482:2 (1968).

Descriptors: *New Hampshire, *Dams, *Maintenance, *Water levels, Administrative agencies, Administration, Legislation, Water law, Water policy, Legal aspects, Regulation, Water rights, Decision making, Standards, Investigations, On-site investigations, Planning, Evaluation, Hydrolic data, Inspection, Flood control, Public benefits, Public health.

In the interest of public good the water resources board makes such inspections with respect to high or low water levels in the inland public waters of the state and the rights, instrumentalities and practices whereby such levels are affected or controlled which best promote the public health, safety, enjoyment and value of public waters. Records of water flow and the like must be made available to the board after a reasonable request of same so that owners and managers of dams may be advised of the need for variations of run-off and so that they may better plan for and anticipate emergencies. The board calls conferences with dam owners for the purpose of obtaining cooperation in the regulation of stream flow to minimize damage to public and private property at times of high water. Any time the board feels that public health or safety may be jeopardized it recommends action concerning storage or release of water as it deems necessary. (Johnson-Fla)
W69-09090

PUBLIC SERVICE COMPANIES.
SC Code Ann, secs 58-967, 58-991, 58-992 (1962).

Descriptors: *South Carolina, *Railroads, *Culverts, *Drainage, Legislation, Regulation, Bridges, Bridge construction, Damages, Floodwater, Administrative agencies, Navigable waters, Tidal waters.
Identifiers: *Railroad crossings.

Landowners may recover damages from railroad corporations for all injuries caused by the wrongful obstruction of watercourses by such corporations and it shall not be necessary to allege or prove negligent construction of any works of such co poration. Public Service Commission shall contro by special order, the manner in which any street railroad track crosses any railroad track so as to e fect proper drainage of adjacent territory. No rai road shall be constructed to cross another railroa at the same level or across navigable or tidewate without the written consent of the Public Servic Commission, nor except in the manner it sha prescribe. (Kahle-Fla)
W69-09095

ARKANSAS POWER AND LIGHT CO. V CAS (OPERATION OF DAMS IN FLOODS).

432 SW 2d 853-861 (Ark 1968).

Descriptors: *Arkansas, *Flood damage, *Floo control, *Reservoir operation, Discharge (Water Judicial decisions, Dams, Floodgates, Watershe management, Water levels, Lakes, Rivers, Floo forecasting, Reservoirs, Weather forecastin Floods, River forecasting, Surface runoff, Crop Electric powerplants, Watercourses (Legal), Leg aspects.
Identifiers: Crops damage, River bottom land Sour crops.

Plaintiffs and other farmers owned land on a ce tain river below two dams owned by defendan Flood waters produced by a sudden rainstorm ove flowed plaintiffs' lands and caused their crops t sour. Plaintiffs claimed that defendant's negligen operation of the dams caused the floodwaters t remain on the land longer than normal causing th souring of the crops. The court held that even if de fendant had been negligent, the evidence did no show that his negligence was the cause of the plain tiffs' damages. The evidence did show that defen dant had discharged water from the dams in such manner as to prevent higher flood levels. Thi method of discharge did cause floodwaters t remain on plaintiff's land longer. However, th court found that there was no evidence to sho that if another method of discharge had been use the crops would not have been destroyed. Th court felt that the crops might have been destroye if water had been left on the crops a much shorte time. The defendant may have been negligent i not using weather forecasts and discharging wate in relation to their predictions, but the court fe this negligence could not be shown to be the caus of plaintiffs' damages. Defendant received directed verdict. (Gadd-Fla)
W69-09103

EDWARD V MASSETT (IMPROVEMENT O STREAM AS DRAINAGE OUTLET).

164 NW 2d 382-386 (Minn 1969).

Descriptors: *Minnesota, *Natural flow, *Drainag systems, *Outlets, Stream flow, Flow, Channels Streams, Riparian land, Riparian rights, Eminen domain, Compensation, Floods, Runoff, Strean erosion, Erosion, Judicial decisions, Drains Damages, Water law, Ditches, Riprap, Legislation
Identifiers: Constitutional law.

Petitioners owned land abutting on a natura stream forming the outlet for numerous drainag ditches. Petitioners claimed the stream was of in sufficient capacity to carry the water from all th ditches and, as a result, caused inundation and ero sion of their land. They brought an action seekin enlargement and deepening of the stream. An en gineer was appointed to make a study. He recom mended two alternative plans to improve th stream. The trial court rejected both plans, one a being ineffective and the other as being too costly Petitioner appealed on constitutional due proces grounds, contending that the flooding and erosio resulted in a taking of land without just compensa tion. The supreme court affirmed holding that sinc petitioners could have objected to the constructio of the ditches on the grounds of the inadequacy o the outlet when the drainage system was bein

tablished, they could not later claim a constitu-
onal right to the improvement. (Helwig-Fla)
69-09106

LOODS, STREAMS, AND DRAINAGE.

t Stat Ann tit 19, secs 1231-1232, 1251-1252,
271-1273, 1291-1296 (1968).

escriptors: *Vermont, *Administrative agencies,
Local governments, *Water policy, Legislation,
ater law, Legal aspects, Jurisdiction, Drainage,
itches, Flood routing, Floodwater, Controlled
ainage, Eminent domai n, Highways, Highway
location, Embankments, Road construction,
idges, Flood control, Civil engineering, Drainage
stems, Flood damage, Flow control.
entifiers: Damages, Adjudication procedure,
ompensation, Public health.

lectmen may change the location of a bridge, if
ch bridge is swept away by a flood, to a location
hich is less exposed but must assess and tender
mpensation to persons injured by such reloca-
n. To protect a highway from damages due to
od waters or ice jams the course of a stream may
diverted by the selectmen or road commis-
oners. Persons dissatisfied with such a decision
ay ask the county court for a new hearing on the
atter. When embankment of a stream is necessary
protect a highway under construction or repair
d the owner of the property over which the
ream flows asks for excessive compensation for
lowing same, the selectmen must determine the
ecessity of such embankment and then, if necessa-
, assess reasonable damages. The selectmen are
so responsible for location, establishment and
nstruction of appropriate drains, ditches and
atercourses as are deemed necessary for t he
ublic health within their jurisdiction and are
sponsible for paying appropriate damages to lan-
owners who are injured by such actions. If such a
ndowner is not satisfied by the damages thus
warded, he may petition a district judge for a reap-
raisal of the damages. (Johnson-Fla)
69-09116

LLINOIS AND DESPLAINES RIVERS.

l Ann Stat ch 19, secs 38-41 (Smith-Hurd 1963).

escriptors: *Illinois, *Navigable rivers, *Channel
provement, *Navigation, Dams, State govern-
ents, Federal government, United States, Ad-
inistrative agencies, Channels, Lake Michigan,
ater supply, Rivers, Navigable waters, Streams,
bstruction to flow, Legislation, Legal aspects,
ater law, Water policy, Grants.
entifiers: Slack-water.

he State Works at Henry and Copperas Creek and
e river now slack-watered by said works, are
reby ceded to the United States on the condition
at existing dams be removed whenever sufficient
pth for navigation can be secured through chan-
l improvement. If acceptance of the said works
this condition does not occur within 4 years
ter this act becomes law, the Illinois Department
Public Works is authorized to remove the dams
Henry and Copperas Creek. This act of cession is
sed upon the condition that the plan of improv-
g navigation in the Illinois River by dams and
cks be changed to a plan of improvement by an
en channel in conjunction with a water supply
m Lake Michigan. The DesPlaines and Illinois
ers are hereby recognized as and declared to be
vigable streams. Explicit authority from the
neral Assembly is necessary for the erection of
y structure in or across said streams. The Gover-
r and General Assembly are hereby authorized
d directed to take the legal actions necessary to
move all and every obstruction in said rivers that
erfere with the intent and purpose of this act.
arruthers-Fla)
69-09119

PROPAGATION OF THE FLOWS DISCHARGED BY THE 'GHEORGHE GHEORGHIU-DEJ' HYDROELECTRIC PLANT IN THE ARGES RIVER BED (ROMANIAN),
Institute of Hydrotechnical Research, Bucharest (Rumania).
Romeo Amaftiesei, and Gheorghe Popa.
Hidrotechnica, Gosp Apelor, Meteorol, Vol 13, No 5, p 238-243, May 1968. 6 p, 11 fig, 4 ref.

Descriptors: *Discharge measurement, *Hydroelectric plants, *Hydrologic data, Rivers, Infiltration, Seepage, Hydraulic properties, Porosity, Permeability, Gravels, Sands, Bank storage.
Identifiers: *Romania, Arges River flow.

The hydrologic regime of Arges River underwent important changes as a result of discharges from the 'Gheorghe Gheorghiu Dej' hydroelectric plants. Field studies were conducted between July 20-22 and Aug 1-2, 1967 to determine how the discharged water from the plant was propagated in the Arges River. Measurements were made on the evacuation channels of the hydroelectric plants and in 3 additional points along the river course. It was observed that an increase in flow downstream was accompanied by a corresponding reduction in the flow volume. This phenomenon was explained by lateral infiltration of water into the river banks. The variations of water level in observation wells confirmed the above hypothesis. Large amounts of water are stored in highly porous gravels and sands during the high flow. The water flows back into the river when the water level in the river decreases. The amount of water stored in the river banks was calculated by using a mathematical formula in which water level, infiltration coefficient, and active porosity of river banks were used. Wave attenuation was also calculated by using longitudinal and transversal profiles between Oesti and Malu Spart. (Carstea-USGS)
W69-09166

TIME LAPSE AERIAL PHOTO ANALYSIS OF THE CONNECTICUT RIVER FROM 1952 TO 1965,
Massachusetts Univ., Amherst. Dept. of Forestry and Wildlife Management.
For primary bibliographic entry see Field 07B.
W69-09243

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN FLORIDA.
Corps of Engineers, Atlanta, Ga. South Atlantic Div.

Corps Eng Water Resources Develop Rep, Jan 1, 1969. 88 p, 47 photo, 2 maps, index.

Descriptors: *Water management (Applied), *Florida, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training, Canals.
Identifiers: U.S. Army Corps of Engineers projects (Fla).

U.S. Army Corps of Engineers water resources development project in Florida are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects is outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-09262

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY OF ENGINEERS IN MINNESOTA.
Corps of Engineers, Chicago, Ill. North Central Div.

Corps Eng Water Resources Develop Rep, Jan 1, 1969. 56 p, 3 fig, 20 photo, 1 map, index.

Descriptors: *Water management (Applied), *Minnesota, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U.S. Army Corps of Engineers projects (Minn).

U.S. Army Corps of Engineers water resources development projects in Minnesota are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects is outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-09263

HYDRAULIC ENGINEERING (HUNGARIAN),
A. Filipkowski, N. Laszlo, Z. Zorkoczy, O. Radai, and A. K. Basu.
Vizugyi Kozlemenyek, Lapkiado Vallalot, Budapest, Issue No 1, 1969. 186 p, 68 fig, 12 tab, 208 ref.

Descriptors: *Water utilization, *Water balance, *Slope stability, *Streamflow, *Karst, *Dams, Landscaping, *Pollution abatement, *Instrumentation, Snowmelt, Hydraulic engineering, Reservoir construction, Water users.
Identifiers: *Poland, *Hungary, Water problems.

This volume of 186 pages consists of 10 articles and reviews by Hungarian, Polish, and other writers discussing various hydrologic problems and water utilization on the basis of hydrogeological and hydraulic engineering data and considerations. The volume contains the following articles: (1) Contemporary problems of water-household balance in Poland by Filipkovski, Andrzei; (2) Hydraulic problems in slope stability, by Nagy Laszlo; (3) Regulation of the Hungarian Upper Danube, by Zorkoszy, Zoltan; (4) Interpretation of aerial photographs in karstic-water research, by Radai, Odon; (5) Construction of a barrage in the mouth of the Eider River, by Kezdi, Arpad; (6) Landscaping along surface waters, by Hazslinsky, Tamas; (7) Industrial pollution of the Darnoda River (India), by Basu, A. K.; (8) New measuring instruments and methods in the hydrological observation network, reviewed after R. W. Carter by E. Varsa; (9) Runoff from snowmelt water, reviewed after F. A. Bertle by M. Hegedus; and (10) The largest navigation lock of the World, in Belgium, reviewed by G. Kontur. (Gabriel-USGS)
W69-09266

FLOOD PLAIN INFORMATION, SOUTH FORK ZUMBRO RIVER AND TRIBUTARIES, ROCHESTER, MINNESOTA.
Corps of Engineers, St. Paul, Minn.

Corps Eng Flood Plain Rep, Aug 1968. 104 p, 32 fig, 40 plate, 20 tab.

Descriptors: *Floods, *Flood damage, *Minnesota, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Rochester (Minn), Standard project flood, Intermediate regional flood.

Flooding of South Fork Zumbro River, Rochester, Minnesota is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)

W69-09286

CERTAIN LOCAL PROVISIONS (FORMATION OF DRAINAGE DISTRICTS).

SC Code Ann secs 18-751 thru 18-760 (1962).

Descriptors: *South Carolina, *Drainage, *Drainage districts, *Local governments, Riparian land, Streams, Swamps, Reservoirs, Lakes, Dams, Basins, Canals, Drains, Ditches, Federal government, Construction, Paving, Sewage districts, Cities, Cost sharing, Road construction, Contracts, Administrative agencies, Bridges, Legislation, Obstruction to flow.
Identifiers: Dragline, Counties, Obstruction to drainage, Penalties (Criminal), Competitive bidding, Notice.

Contiguous landowners in Anderson County on a stream on which there is a swamp, may form a drainage district to rid themselves of such swamp. If feasible, they may construct a lake or dam instead of draining such swamp. Any person obstructing drainage in Charleston County is subject to fine or imprisonment. The governing body of Charleston County may cooperate with federal agencies in the construction and paving of drainage and sewer projects in municipalities, if the municipality provides at least half the necessary funds. The governing body of Charleston County shall not enter any contract for drainage work unless sealed competitive bids are first received. A drainage commission is established in Georgetown County which shall have supervision of the county dragline and shall designate the areas of the county to be drained. (Shevin-Fla)
W69-09348

DRAINAGE DISTRICTS UNDER 1920 ACT.

SC Code Ann secs 18-421 thru 18-432, 18-441 thru 18-463 (1962).

Descriptors: *South Carolina, *Drainage districts, *Administrative agencies, *Drainage practices, Jurisdiction, Local governments, Legislation, Water law, Water policy, Legal aspects, Political aspects, Land management, Drainage, Conservation, Land, Land classification, Land development, Land forming, Land reclamation, Flood control, Reclamation, Riparian land, Financing, Assessments, Drainage programs.

Drainage districts may be formed by the State Budget and Control Board or a majority, in numbers or in acreage, of the holders of any contiguous body of swamp, wet or overflowed lands for the purpose of having such lands reclaimed and protected from the effects of water by drainage or otherwise. Before the formation of any drainage district, en election must take place in which a majority of the freeholders of the land which is to be embraced in the district must approve the additional assessment, levy of taxes and issuance of bonds. Also prerequisite to formation of such a district is a petition signed by a majority of the freeholders within the proposed district which must be filed in the appropriate court of common pleas. If objections are overruled and the court finds the proposal to be beneficial to the public health, convenience or welfare, the district is declared a corporation. In a meeting of the local landholders, supervisors for the district are elected and they in turn must appoint a number of administrative personnel including an engineer, a treasurer and overseers. (Johnson-Fla)
W69-09361

THE APPLICATIONS OF THE TECHNIQUES OF SPACE TECHNOLOGY TO WATER RESOURCE CONTROL,
TRW Systems, Redondo Beach, Calif.; and TRW Systems, Houston, Tex.
For primary bibliographic entry see Field 06A.
W69-09368

OPTIMAL CONTROL OF A STORAGE RESERVOIR DURING A FLOOD SEASON,
Technion - Israel Inst. of Tech., Haifa.
Oded Levin.
IFAC, Haifa Symp, Comput Contr Nat Resources, Public Util, September 1967. 20 p, 2 fig, 4 ref.

Descriptors: *Optimization, *Control systems, *Flood forecasting, *Reservoir storage, *Overflow, Risks, Markov process, Mathematical models, Water level fluctuations, Transition flow, Water supply.

The study considered the deriving of optimal operating rules for regulating the outflow from a reservoir during a flood in order to minimize water losses due to spills while not exceeding a specified probability that an overflow would occur. A mathematical Markov model was formulated for analyzing the problem. The optimal control functon for the fld season was established and the transition probabilities between each subsequent periods could be computed. Using a Markov chain procedure and proceeding in a chronological order the elements of the seasonal transition probability matrix were computed. The solution provided rules also for continuous control of the outflow from the reservoir as a function of time, water level and any other information concerning the system's state. (Thiuri-Cornell)
W69-09370

THE STATE NAVIGATION SERVITUDE,
Daniel J. Morgan, and David G. Lewis.
Land and Water L Rev, Vol 4, No 2, p 521-538, 1969. 18 p, 85 ref.

Descriptors: *Riparian rights, *Navigable waters, *Condemnation, *Compensation, Legal aspects, Ownership of beds, Easements, State governments, Banks, High water mark, Civil law, Water law, Public benefits, Public rights, Beds under water, Legal aspects, Riparian land.
Identifiers: Navigational servitude.

The state navigation servitude is an exception to the rule that private property cannot be taken by the state without just compensation. The state can limit or take riparian rights of private property owners under this servitude. The theory behind the taking is that the state holds an easement over the navigable waters and their beds for the public to use for navigation. Thus, as long as the taking can be shown to be for the purpose of navigation the state has no obligation to pay compensation. There are three main views of the state navigational servitude. One group of states follows the 'general rule' which allows states to take riparian rights if the taking is to aid navigation. But just compensation is due the riparian owner if the taking is for any other purpose. Another group of states follows the 'public purpose exception to the general rule' which allows the states to extend the no-compensation aspect of the navigation servitude to any government project purposes. The 'Louisiana exception to the general rule' developed from civil law which grants the state an easement to the banks of the upland property owners. The easement includes projects for navigation and extends to such things as levees and roads. (Gadd-Fla)
W69-09377

PORT DISTRICTS.

Mich Comp Laws secs 120.1 thru 120.56 (1967), as amended, (Supp 1968).

Descriptors: *Michigan, *Port authorities, *Harbors, *Navigable waters, Legislation, Administrative agencies, Construction, Taxes, Piers, Docks, Canals, Locks, Watercourses (Legal), Operation and maintenance, State governments, Artificial watercourses, Leases, Financing, Local governments, Bonding, Legal aspects, Regulation.
Identifiers: *Port districts, Ferries.

The creation of port districts in various counties of the state is herein authorized. These districts shall have all the powers specifically granted to t and any powers implied or necessary for the e cise of the powers specifically granted. Proced are provided for the establishment of the dis The appointment and duties of a port commis are provided for. Each port district shall have power to construct, acquire, maintain, and ope seawall jetties, piers, wharves, docks, fer canals, locks, and seaways. The district may regulate the construction of structures in navig waters. Each port commission may create and prove any waterways for harbor purposes and r late and control all such waterways and all na or artificial waterways within the limits of the trict. The district is also given the power to taxes, lease or sell property, and issue bo (Heckerling-Fla)
W69-09380

UNITED STATES V 2,648.31 ACRES OF L (CONDEMNATION OF FLOWAGE RIGHTS)

218 F 2d 518-524 (4th Cir 1955).

Descriptors: *Eminent domain, *Easeme *Flooding, *Property values, Flood con Federal government, Dams, Multiple-purpose jects, Condemnation, Compensation, Dama Flood damages, Run off, Reservoirs, Terrain an sis, Dam design, Judicial decisions, Legal aspe United States.
Identifiers: *Flowage easements.

Appellees owned land part of which was to be ject to intermittent flooding in connection wi flood control dam. In an action to condem flowage easement over the land appe recovered the fee simple value of the land. The court excluded testimony tending to show that all the land would be permanently flooded. government appealed contending that an impro measure of damages had been used. The cou appeals reversed the lower court, holding that measure of damages for taking of flowage ri must be construed in connection with the part lar project. Where it can be shown that land u which there are flowage rights will be flooded intermittently and the landowner would still substantial use of the land, this evidence shoul admitted. The measure of damages would be difference in the value of the land before and a condemnation of the flowage easement. The downer would have the right to recover fur damages if in the future there was further floo from a change in the operation of the dam proj (Helwig-Fla)
W69-09383

RUSSELL FORK COAL CO V HAWKINS (L BILITY FOR FLOODING CAUSED BY ST MINING).

311 Ky 449, 223 SW 2d 887-892 (1949).

Descriptors: *Kentucky, *Strip mines, *Exces precipitation, *Flood damage, Legal aspects, F floods, Obstruction to flow, Retaining walls, S mine wastes, Judicial decisions, Floodwater.
Identifiers: *Debris, *Negligence.

Plaintiffs sued for damages allegedly caused by fendant's negligent strip mining operation. Pl tiffs contended defendant excavated three or acres to mine coal and cast the debris from this cavation into the head of a creek below the mo tain. The excavation filled with water, and plain alleged heavy rains broke an earth retaining The subsequent flow of water into the creek be carried the debris in a flood crest which dama plaintiff's property. The jury in the circuit c gave judgment for plaintiff in the sum of $10,0 On appeal, the court of appeals reviewed exten testimony concerning the volume of rain damages and nature of the flooding and held the evidence did not support a conclusion water in the excavation caused the damage c plained of. Even if filled to capacity the excava

er would have been of negligible effect as com-
ed to the total volume of rainfall which caused
flood. The court reversed the judgment for
ntiffs. (Harris-Fla)
9-09384

NSTRUCTION OF DRAINAGE SYSTEMS.

n Stat Ann secs 106.021, 106.031, 106.071
106.211 (1964), as amended, (Supp 1969).

criptors: *Minnesota, *Drainage systems, *Lo-
governments, *Engineering, Ditches, Lakes,
nnels, Eminent domain, Riparian rights, Lakes,
ninistrative agencies, Flood control, Water law,
islation, Surveys, Projects, Drains, Drainage,
efits, Damages, Engineers estimates, Main-
nce, Construction, Public benefits.

county boards and the district courts shall have
er to make all necessary orders for and require:
construction and maintenance of public
nage systems; (2) drainage of lakes; and (3)
d control. Before any public drainage system is
blished a petition therefor, signed by a majority
andowners to be effected shall be filed. The
em must be for the public benefit and welfare.
r the petition is filed the board shall appoint an
ineer to make a survey of t he proposed system.
engineer shall make a preliminary survey and
ort his proposals thereon. After the filing of the
ineers report, there shall be a hearing upon his
posals, notice thereof being sent to all in-
sted persons. The board or court may approve
plan if it is determined to be for the public
efit. The engineer shall then proceed with a
ailed survey including maps showing all details
he system, plans for bridges, soil surveys, and
cifications. The board shall appoint disin-
sted viewers to determine the benefits or
nage to land, and they shall report their findings.
efit assessments and damages shall be based
n such reports. (Helwig-Fla)
9-09385

ANDONMENT OF HIGHWAY FOR CON-
UCTION OF DAM; ACQUISITION OF
ND.
n Gen Stat Ann sec 13a-54, 13a-72, 13a-73,
-75 (1958).

criptors: *Connecticut, *Dam construction,
ghway relocation, *Condemnation, Road con-
ction, Dams, Eminent domain, Compensation,
ess routes, Right-of-way, Highways,
kwater, Flooding, Flood damage, Real proper-
Property values, Legislation, Legal aspects,
nages.

person or corporation who wishes to construct
m which will cause any highway to be flooded
abandoned must reach a written agreement
the parties liable for maintaining that highway.
written agreement must be recorded in the
t clerks office of the town or towns where the
way to be abandoned is located. If no agree-
t can be reached, the superior court of a coun-
which the highway is located may grant per-
ion to flood the highway and award damages to
parties liable for maintaining the highway.
wise, the highway may be relocated upon writ-
recorded agreement between the parties in-
d or, if no agreement can be reached, upon
rder of a superior court. The commissioner
take or purchase all lands necessary for the
truction of highway drainage systems. The
rs of such lands shall be paid damages as as-
d by the commissioner. Land damaged by
or other natural disaster shall be given a value
it had been restored to full productive use.
rielson-Fla)
-09386

INING LANDS.
nn Code Art 25, secs 52-95 (1957).

Descriptors: *Maryland, *Drainage districts, *Drainage programs, *Surface drainage, *Land reclamation, Local governments, Right-of-way, Controlled drainage, Ditches, Canals, Culverts, Drainage engineering, Easements, Condemnation, Damages, Flood control, Water management (Applied), Legal aspects, Legislation, Construction, Drainage systems.

Authority is granted to the boards of county commissioners to establish public drainage associations for the purpose of draining swampy lands and lands subject to overflow. The commission operates through a board of drainage viewers which, in turn, appoints a board of managers for each improvement project. The title provides for the acquisition of rights-of-way and easements needed to carry out drainage projects, the funding of these projects, and the composition and duties of the boards of drainage viewers and the board of managers for each drainage district. (Kelly-Fla)
W69-09387

DRAINING LANDS.
Md Ann Code Art 25, secs 87 to 95 (1957).

Descriptors: *Maryland, *Drainage districts, *Drainage programs, *Surface drainage, Land reclamation, Controlled drainage, Drainage engineering, Drainage systems, Local governments, Legislation, Legal aspects, Flood control, Ditches, Canals, Culverts, Construction.

The board of managers of each drainage district may employ laborers and purchase or rent machinery to carry out improvements. The board is charged with maintaining drainage improvements in good repair and may levy a drainage tax for this purpose on the lands benefited. Authorized improvements which would interfere with, or cause removal of, any milldam, or divert water so as to deprive the owner of a milldam of its use, may not be constructed. Obstructing the flow of water through any ditches or other improvements made pursuant to this title is a misdemeanor and is punishable by fine. Where improvements are constructed so as to cross public highways at intersections with natural watercourses, the costs of culverts and bridge enlargements must be borne by the highway authority. Where there is no intersection with a natural watercourse, the drainage association must assume the costs. A majority of the landowners in a public drainage association may petition the board of county commissioners for dissolution of the association. (Kelly-Fla)
W69-09388

DUTIES OF DEPARTMENT OF CHESAPEAKE BAY AFFAIRS.
Md Code Ann art 14B, secs 12-13 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Navigation, *Administrative agencies, *Tidal waters, Federal government, State governments, Legislation, Boats, Boating, Harbors, Rivers and Harbors Act, Wastes, Channels, Engineering structures, Dredging, Water districts, Public benefits, Taxes, Regulation, Control, Legal aspects, Cooperation, Water pollution control, Projects, Construction, Financing.
Identifiers: *Chesapeake Bay, *Obstruction of navigation, Towing, US Army Corp of Engineers, Penalties (Civil).

The Department of Chesapeake Bay Affairs is charged with the duty of enforcing any laws applicable to boats using the waters of the state. Its other duties include clearing the waters of logs and other debris which constitute obstructions to navigation and cooperation with federal, state or local agencies which make funds available for its operation. The Department shall tow disabled vessels to the nearest harbor but shall not compete with commercial towing services. It is unlawful for any person to deposit refuse on any waters of the state. The Department shall mark channels in the waters of the state. The Department may establish areas as waterways improvement districts. The Department is to provide liason with the United States Army Corp of Engineers on projects under the Rivers and Harbors Act. It may construct marine facilities beneficial to the boating public. Projects may be financed by special assessments levied against property owners in the district. Any person violating any section of the article is guilty of a misdemeanor. (Shevin-Fla)
W69-09390

DRAINAGE DISTRICT UNDER 1920 ACT.

SC Code Ann secs 18-541 thru 18-579, 18-591 thru 18-599, 18-611 thru 18-616, 18-621 thru 18-638 (1962).

Descriptors: *South Carolina, *Drainage districts, *Drainage systems, *Taxes, Legislation, Drainage, Local governments, Drainage programs, Land, Land tenure, Construction, Construction costs, Assessments, Canals, Ditches, Drains, Boundaries (Property), Watercourses (Legal), Excavation, Bridges, Condemnation, Financing, Operation and maintenance, Bonding, Legal aspects, Administration.

Land within a drainage district shall be taxed proportionately to the benefits it will receive. Delinquent lands may be sold to satisfy the taxes. Bonds may be issued to meet the costs of construction. Funds derived from the sale of such bonds shall be used to pay the cost of the drainage works. A maintenance tax may be levied on land to maintain drains, ditches, or other improvements. Landowners may petition for a readjustment of the tax and a hearing will be held to determine whether such readjustment will take place. The supervisors of the district may petition the court for an order extending its boundaries. Previous drainage systems in the district may be connected with the new system. Any landowner may construct a bridge over any drain, ditch, canal, or excavation. (Shevin-Fla)
W69-09393

DAMS AND DRAINS.
SC Code Ann Secs 18-201 thru 18-205 (1962).

Descriptors: *South Carolina, *Administrative agencies, *Drainage districts, *Regulation, Water law, Water policy, Legal aspects, Legislation, Local governments, Administration, Flood control, Drainage, Multiple-purpose projects, Project purposes, Projects, Reclamation, Surface drainage, Tidal marshes, Public benefits, Public health.

Drainage of swamps, drainage of surface water from agricultural lands and reclamation of tidal marshes are considered public benefits and conducive to the public health. This chapter shall be liberally construed to promote the leveeing, ditching, draining and reclamation of wet overflowed lands. This chapter has no effect on local drainage laws enacted by the General Assembly. The clerk of the court of common pleas keeps the 'Drainage Record' in which every petition, motion, judgment, and order of the board in every drainage transaction which may come before it is recorded. (Johnson-Fla)
W69-09394

TAX DITCHES.
Del Code Ann tit 7, secs 4171-4182 (1953), as amended, (Supp 1966).

Descriptors: *Delaware, *Administrative agencies, *Drainage, *Taxes, Assessments, Administration, Costs, Operating costs, Tax rate, Legislation, Legal aspects, Water law, Financing, Budgeting, Ditches, Drainage districts, Drainage practices, Drainage programs, Maintenance.
Identifiers: *Tax ditches.

The County Board of Assessments keeps a current assessment list in a special assessment book of all

tax ditches formed under this chapter and is assisted by the state drainage engineer in making such appropriate changes in the special ditch assessment books as are warranted by transfers of property located therein. The tax is based on the ratio between the assessment lease for each parcel of property and the total assessment base for the tax ditch. These taxes are collected by the Receiver of Taxes and County Treasurer and are put in separate accounts to be drawn by officers of the respective ditch companies from which the taxes come. Loans may be secured by a tax ditch upon a pledge of the tax warrants from such ditch. Subject to state and county taxes, all taxes levied under this chapter are paramount over other liens on the property taxed. With the consent of the County Soil Conservation District ditch managers may regulate the amount of tax necessary to defray the cost of annual maintenance on such ditches. (Johnson-Fla)
W69-09397

ALLEN V NEW YORK STATE WATER RESOURCES COMM'N (DAMAGE FROM DAM CONSTRUCTION).

299 NYS 2d 586-589 (1969).

Descriptors: *New York, *Dam construction, *Administrative agencies, *Competing uses, Property values, Public rights, Jurisdiction, Damages, Legislation, Water law, Legal aspects, Water policy, Project purposes, Riparian rights, Water rights, Artificial use, Civil law, Relative rights, Riparian waters, Riparian land, Regulation, Public health.

Petitioners brought suit in the Albany Supreme Court to obtain a judgment annuling the determination of respondent Water Resources Commission that a dam might be constructed on the Cayuta Lake Outlet. Petitioners alleged that private damages would follow which would diminish the value of their lands. Under conservation law regulations the Commission must determine whether such construction is contrary to the public interest and whether it would endanger the public health, safety and welfare or the state's natural resources. The Commission made the determination that the public requirements were met, but did not determine the relative merits of t he private interests involved. Pursuant to their finding the Commission did not establish a lake level or mandate the construction of a dam but merely found that no public interest would be violated by a dam with a crest not above a certain elevation. The court held in affirming the Commission's finding that, while there is still recourse through the courts for private injuries, the Commission's finding that the project was not contrary to public interest was within the scope of its authority. The proceeding was dismissed. (Johnson-Fla)
W69-09399

GRATHWOHL V HIWAY WONDERLAND INC (FLOOD DAMAGE FROM LOWER RIPARIAN DAM).
298 NYS 2d 1020-1021 (NY App Div 1969).

Descriptors: *New York, *Dams, *Riparian rights, *Remedies, Relative rights, Judicial decisions, Legal aspects, Riparian land, Flood control, Damages, Backwater, Evaluation, Value, Property values, Operation and maintenance, Water levels, Flood damage, Flooding, Land tenure.
Identifiers: *Injunction, Trespass.

Upper riparian owners sought injunctive relief to prevent flooding by a dam constructed by the lower riparian owners. The trial court found evidence that the dam was causing the flooding. It therefore enjoined the defendants from closing the port holes or raising the existing height of the dam. The court further held it could not award damages since the plaintiffs offered no proof of valuation or the cost of restoration. The plaintiffs appealed for further relief to enjoin the defendants from maintaining the dam higher than the stream bed where the stream left the plaintiffs' property. Sustaining the factual findings in the record, the appellate court modified the judgment in providing that the plaintiffs could seek additional relief for further substantial injury at the foot of the judgment or could bring separate actions for any subsequent injury. The court found the defendants were continuing to commit a technical trespass. (Breeze-Fla)
W69-09400

CONTROL OF CERTAIN SALVAGE OPERATIONS.

S C Code Ann secs 54-321 thru 54-328 (Supp 1968).

Descriptors: *South Carolina, *Legislation, *Regulation, *State jurisdiction, Proprietary power, Low water mark, Ownership of beds, Navigable waters, Riparian rights, Salvage value.
Identifiers: *Shipwrecks, *Archaeology, *Artifacts.

Title to the bottoms of navigable waters within one marine league seaward from the Atlantic Seashore, measured from the mean low water mark, and title to all shipwrecks, vessels, and all things therein remaining unclaimed for more than ten years is declared to be in the state of South Carolina. The custodian of these shipwrecks, vessels and all things therein is the State Department of Archives and History which may issue a permit to conduct salvage operations for shipwrecks. Money derived from this source may be used by the Department. Penalties for conducting unauthorized salvage operations for shipwrecks are provided. (Moulder-Fla)
W69-09404

BATTJES BUILDERS V BOUMA (COUNTY DRAIN PROJECT).

167 NW 2d 123-126 (Ct App Mich 1969).

Descriptors: *Michigan, *Drainage, *Public health, *Administrative agencies, Judicial decisions, Assessments, Flood protection, Natural streams, Local governments, Construction, Taxes, Administrative decisions, Adjudication procedure.
Identifiers: Whiskey Creek drain, Drain Commission, Injunctions (Prohibitory).

Plaintiffs sought to enjoin defendant drain commission from constructing a county drain. Plaintiffs contended that the drain, in benefiting only one party, would not be conducive to the public health, welfare and convenience as required by the drain code. The court found that the drain would serve plaintiffs as well as others. This was held to be sufficient to satisfy the drain code requirement. Plaintiffs' second contention was that defendant commission should have established a new drain instead of improving an existing drain which was a natural watercourse. The court found that a natural watercourse was included in the statutes defining drains. Also, the court found that the legislature had intended the improvement of natural watercourses to be within the drain code. The court stated that the drain commission could contract with a private person for the construction of drain facilities part of the consideration for which would be the relief of assessments made upon the private person. (Gadd-Fla)
W69-09414

WATER SUPPLY; SANITATION.

Vt Stat Ann tit 18, sec 108 (1968).

Descriptors: *Vermont, *Water supply, *Drainage, *Cities, Administrative agencies, Local government, Sewage, Construction, Buildings, Legislation, Legal aspects.
Identifiers: Sanitation.

The commissioner of health, when request when he deems necessary, may advise mun officers in regard to drainage, water supply sewerage of towns and villages and in regard t erection, construction, heating, ventilation sanitary arrangements of buildings. (Shevin-Fl W69-09419

LAKE CALUMET HARBOR.

Ill Ann Stat ch 19, secs 113-118 (Smith-1963).

Descriptors: *Illinois, *Harbors, *Construc *Maintenance, Cities, Leases, Industries, C Legislation, Legal aspects, Engineering struct Navigation, City planning, Maintenance Operation and maintenance, Utilities, Navi waters, Administrative agencies.
Identifiers: Lake Calumet, Chicago.

Chicago may construct a harbor of spe minimum depth and area. The acceptance b city of lands granted by this act obligates the c maintain the harbor. The city may convey or any land granted by this act for industrial, man turing, or harbor purposes. The deed or lease stipulate that the land shall be used within a ce time for the purpose authorized. The Depart of Public Works and Buildings must approv such sales and leases. If the Department tak action on the application within thirty days of i ing, the sale or lease is deemed approved. M from these sales and leases is credited to the Calumet Harbor Fund forrbor maintenance other related uses. (Breeze-Fla)
W69-09421

LEVEL OF LAKE MICHIGAN.

Ill Ann Stat ch 19, secs 119-120 (Smith-1963).

Descriptors: *Illinois, *Great Lakes, *Water l *Regulation, Administrative agencies, Coor tion, Lake Michigan, Water conveyance, Sur Cities, Planning, Construction, Projects, Le tion, Legal aspects, Lakes, Federal governm State governments, Administration, Pr planning, Data collections, Contracts.

The Department of Public Works and Buil shall regulate and maintain the levels of the Lakes and also suggest regulations for the dive of water therefrom. It shall make all necessary veys and enter into any agreements with cities other agencies, both state and federal, in ord carry out these duties. (Breeze-Fla)
W69-09422

CHICAGO PARK DISTRICT AND CONSTI TION OF HARBOR FOR RECREATIO PURPOSES.
Ill Ann Stat ch 105, secs 333.23L to 333 (Smith-Hurd Supp 1969).

Descriptors: *Illinois, *Recreational faci *Harbors, *Parks, Marinas, Land use, Rip rights, Excavation, Breakwaters, Docks, Legislation, Legal aspects, Recreation, Legisla Financing, Land reclamation, Public lands, Be

The Chicaga Park District has the powe acquire, maintain and improve a harbor, ma pier, or other similar structure to be used recreation and public benefit at any location w the jurisdiction of the park district which bo on public waters. To carry out the purposes o title, the Chicago Park District will have the rights over its harbor as it does over its other perty. The district may furnish mooring, doc and repair facilities. It may acquire any nece additional property, reclaim submerged under public waters, and control the use and o tion of the harbor. Any reclaimed lands become part of the public park. The park di

finance the construction of a harbor facility by ng revenue bonds to be paid with income ved from the facility. (Kelly-Fla)
-09424

RATION AND MAINTENANCE OF HAR-S FOR RECREATIONAL PURPOSES.
nn Stat ch 105, secs 11.1-1 thru 11.1-10 ith-Hurd Supp 1969).

criptors: *Illinois, *Recreational facilities, rinas, *Harbors, Parks, Land use, Riparian s, Excavation, Breakwaters, Docks, Piers, slation, Legal aspects, Recreation, Financing, d reclamation, Public lands, Beds.

park district bordering upon public waters has ower to acquire, maintain and improve a har- marina, pier or other structure to be used for eation and public benefit anywhere within the district jurisdiction. To carry out the purposes is title, a park district will have the same rights its harbor as it does over its other property. district may: furnish mooring, docking and ir facilities; acquire necessary additional pro-y; reclaim submerged lands under public rs; and control the use and operation of the or. Any reclaimed lands shall become part of public park. The park district may finance the truction of a harbor facility by issuing revenue ds to be paid with income derived from the ity. (Kelly-Fla)
-09426

FACE WATER PROTECTION DISTRICTS.
nn Stat ch 42, secs 448 thru 471 (Smith-Hurd 6), as amended, (Supp 1969).

criptors: *Illinois, *Administrative agencies, face waters, *Regulation, Legislation, Legal cts, Eminent domain, Right-of-way, Adminis-on, Water utilization, Financing, Taxation, ision making, Local governments, Water con- Flood control, Damages, Bonding.
tifiers: Surface water protection districts.

r a petition, hearing, and election a surface r protection district may be formed to prevent control surface water damage, although under ain circumstances a district may be organized out an election. A similar procedure is fol- d to add new territory to the district. edure for appointment of a board of trustees as as establishment of their powers and duties is ut in detail. The board has authority to adopt enforce ordinances, acquire real and personal erty required for its corporate purposes and if necessary, exercise the power of eminent ain over such property and may also acquire ssary rights of way over public property or pro- held for public use. The district has authority water regulation of cities and towns under its liction. It issues bonds to finance its projects pays the interest and costs thereof through t annual taxes. Property may be detached the district after a proper petition, public ng, and court order. (Johnson-Fla)
-09428

FACE WATER PROTECTION DISTRICTS.

n Stat ch 42, secs 448 thru 451a (Smith-Hurd), as amended, (Supp 1969).

riptors: *Illinois, *Surface waters, *Adminis- e agencies, *Water control, Jurisdiction, lation, Legal aspects, Public health, Ditches, , Channels, Sewers, Damages, Water utiliza- Adjudication procedure, Surface drainage.
ifiers: Surface water control.

interest of public health, safety and welfare e water protection districts may be formed to litches, channels, sewers, dams and other sary construction to protect against injury to nd property due to damage by surface water. To be qualified to become a district the territory must be a contiguous area, not in more than two counties, so situated that establishment of facilities will conduce promotion and protection of public health and safety from damage due to surface water and so situated that the territory is not within the jurisdiction of another district. When fifty or more legal voters of a proposed district petition the circuit court for the establishment of a district such court shall hold a hearing in which residents of the proposed district may appear and be heard. Upon approval of the petition by said court, an election takes place which is supervised by the court and in which a majority of affirmative votes cast is necessary to establish a district. A petition by all the owners of land within a proposed district for an order incorporating a district may be made in lieu of the election procedure outlined previously. (Johnson-Fla)
W69-09429

SURFACE WATER PROTECTION DISTRICTS.

Ill Ann Stat ch 42, secs 452 thru 459 (Smith-Hurd 1956), as amended, (Supp 1969).

Descriptors: *Illinois, *Surface waters, *Administrative agencies, *Jurisdiction, Legal aspects, Water law, Administration, Adjudication procedure, Regulation, Decision making.

All courts must take judicial notice of the existence of surface water protection districts. Such districts constitute a body corporate which may sue or be sued. After a petition by one per cent of the legal voters in a proposed addition to a district and a public hearing before the circuit court, an election is held in which the new area is added to the existing district on the majority vote of those participating in the election. The appropriate county court appoints five trustees who compose the governing board for the district and whose terms are generally five years. Board members and employees of the board are prohibited from having financial interests in the activities, contracts, and work of the district, but are not prohibited from owning land which is taxed for purposes of the district. The court which made the original appointment fills subsequent vacancies on the board. The members of the board of trustees may be compensated up to $250 per annum and have the power to pass all necessary ordinances, rules and regulations for proper management and conduct of the district's business. (Johnson-Fla)
W69-09430

SURFACE WATER PROTECTION DISTRICTS.
Ill Ann Stat ch 42, secs 460 thru 464 (Smith-Hurd 1956), as amended, (Supp 1969).

Descriptors: *Illinois, *Surface waters, *Administration, *Regulation, Legislation, Legal aspects, Eminent domain, Right-of-way, Competing uses, Damages, Administrative agencies, Jurisdiction, Streams, Flow control, Flood control, Water control, Property values, Alteration of flow, Public lands.
Identifiers: Surface water damage control.

All ordinances of the district must be properly posted or published and proof thereof is required to be kept by the corporation's secretary. When surface water protection facilities are acquired from a city or village the district must reimburse such city for the reasonable value of said facilities. The board may adopt and enforce necessary ordinances, acquire real and personal property rights by exercise of eminent domain, if necessary, and also enter upon any public property or property held for public use when making improvements so long as the public use of such property is not unnecessarily or unreasonably disturbed. The board has power, and it is its duty and obligation to provide adequate protection from surface water damage for all persons or property within its jurisdiction and to prescribe necessary regulations for prevention and control of surface water damage. When the board proposes to change the flow or improve the course of any stream it must obtain permission for same from the Department of Public Works and Buildings. (Johnson-Fla)
W69-09431

SURFACE WATER PROTECTION DISTRICTS.

Ill Ann Stat ch 42, secs 465 thru 471 (Smith-Hurd 1956), as amended, (Supp 1969).

Descriptors: *Illinois, *Local governments, *Surface waters, *Taxation, Legislation, Financing, Legal aspects, Jurisdiction, Adjudication procedure, Tax rate, Costs, Operating costs, Administrative agencies, Administration, Bonding.
Identifiers: Surface water protection facilities.

When powers of a district conflict with those of a city or village such city or village shall cease to own, operate, or control surface water protection facilities located within the district's jurisdiction. The board may issue bonds to raise funds for necessary projects subsequent to approval in an election within the district, although districts organized without an election may issue bonds on approval of all landowners within the district. The board may assess taxes to pay indebtedness of the district and the interest thereon and, subject to certain limitations, may also finance their normal corporate activities through taxation. An election must be held to change the tax rate of the district. Before any bonded indebtedness has occurred a petition may be filed with the county court to have property detached from the district if the property is not qualified to belong to the district or if it would be more advantageous to become associated with another district. If, after a proper hearing, the county court finds for the petitioner, an order from said court removes such property from the district. (Johnson-Fla)
W69-09432

RE-LOCATING WATERCOURSES.

Ill Ann Stat ch 24, secs 11-87-1 thru 11-87-5 (Smith-Hurd 1962).

Descriptors: *Illinois, *Alteration of flow, *Streambeds, *Local governments, Streams, Ownership of beds, Navigable waters, Streamflow, Diversion, Channels, Canals, State governments, Highways, Condemnation, Legislation, Construction, Legal aspects, Cities, Artificial watercourses, Natural streams, Landfills.

City and village governments may alter or re-locate the channel, course, or bed of any natural or artificial watercourse within the corporate limits in order to establish, widen, or extend streets or sidewalks. Title to reclaimed land, within the corporate limits, which was part of the bed of the altered stream vests in the city or village. Title to the new stream bed vests in the state. The local government may fill in such portions of a non-navigable canal, slip, or branch of any natural or artificial stream as is necessary to construct streets and sidewalks. The power of the city or village government is limited by state law governing regulation of rivers, lakes, and streams within the state. Property may be condemned when needed to complete the improvements and is within one-half mile of the relocated stream. (Kelly-Fla)
W69-09435

HARBORS FOR RECREATIONAL USE.
Ill Ann Stat ch 24, secs 11-92-1 thru 11-92-6 (Smith-Hurd 1962).

Descriptors: *Illinois, *Harbors, *Recreation facilities, *Cities, Navigable waters, Legislation, Riparian rights, Condemnation, Regulation, Operation and maintenance, Financing, Beds under water, Docks, Shores, Taxes, Land reclamation.

Any city or village of less than 500,000 population which borders on any public waters has the power to acquire, construct, replace, improve, and operate a harbor for the recreational use and benefit of the public anywhere within the jurisdiction of the city, or in, over and upon public waters bordering thereon. The city or village has all the rights and powers over its harbor as it does over its other property. These powers include: (1) furnishing complete harbor facilities, (2) acquiring by gift, devise, purchase, or condemnation any property necessary or appropriate for the purposes of this section, (3) using and reclaiming submerged land under public waters, (4) locating and establishing docks, shores, and harbor lines, and (5) regulating and controlling harbor operation. The land acquired under this act shall be exempt from taxation. The city has the power to borror money by issuing bonds in anticipation of revenue from the harbor. (Heckerling-Fla)
W69-09436

WATERCOURSES, CANALS, WHARVES, AND LEVEES.
Ill Ann Stat ch 24, secs 11-104-1 thru 11-104-3 (Smith-Hurd 1962).

Descriptors: *Illinois, *Watercourses (Legal), *Local governments, *Construction, Repairing, Legislati on, Legal aspects, Navigable waters, Channels, Canals, Docks, Levees, Cities.

The corporate authorities of each municipality of the state may deepen, widen, dock, cover, or alter channels of watercourses. They may construct and repair canals and slips for the accommodation of commerce. In addition, they may construct and repair water-landing places, wharves, docks, and levees. (Kelly-Fla)
W69-09437

REGULATION AND RESTRICTION IN THE LOCATION AND USE OF STRUCTURES.
Ill Ann Stat ch 34, sec 3151 (Smith-Hurd Supp 1969).

Descriptors: *Illinois, *Regulation, *Floodwat er, *Surface waters, Legislation, Damages, Hazards, Storm runoff, Structures, Industries, Runoff, Legal aspects, Overland flow.

Counties may regulate and restrict the location and use of buildings, structures, and land for trade or industry for the purpose of lessening or avoiding the hazards to persons and damages to property resulting from the accumulation or runoff of storm or flood waters. (Heckerling-Fla)
W69-09439

4B. Groundwater Management

THE AVAILABILITY OF GROUNDWATER FOR COOLING PURPOSES (DUTCH),
Rijksinstituut voor Drinkwatervoorziening, Delft (Netherlands).
For primary bibliographic entry see Field 05B.
W69-09048

CHEMICAL AND BIOCHEMICAL ASPECTS OF DISPOSAL OF USED GROUNDWATER BY RECHARGING (DUTCH),
Drinkwaterleiding der Gemeente Rotterdam (Netherlands).
For primary bibliographic entry see Field 05D.
W69-09054

CONJUNCTIVE USE OF GROUND AND SURFACE WATERS,
Calif ornia State Dept. of Water Resources, Los Angeles.
James J. Doody.
J Amer Water Works Ass, Vol 61, No 8, p 395-397, Aug 1969. 3 p.

Descriptors: *Conjunctive use, *Model studies, *Mathematical models, *Groundwater basins, *California, Optimization, Economics, Computer models, Digital computers, Water management (Applied), Water resources development, Surface waters.
Identifiers: Groundwater basin models.

Partial or total application of the methods will provide much of the data necessary for making current management decisions as to the best way of meeting future water demands. Not only can a few arbitrarily selected operational plans be compared by its use, but the tools are also provided whereby an optimum plan can be derived by the local water agency. The economic impact of various legal and political constraints on the optimum plan can also be evaluated. Because this method is written in general terms and preserved in computer programs, it permits rapid updating and adjustment of operating criteria as conditions change, as more geologic and hydrologic information becomes available, and as experience is gained in actual operations. (Knapp-USGS)
W69-09136

HYDROGEOLOGICAL STUDIES FOR DRINKING WATER SUPPLY OF CRAIOVA CITY (ROMANIAN),
Gheorghe P. Constantinescu.
Hidrotehnica, Gosp Cipelor, Meteorol, Vol 13, No 3, p 123-141, Mar 1968. 19 p, 9 fig, 7 tab, 23 ref.

Descriptors: *Water resources development, *Hydrogeology, *Water supply, Geomorphology, Potable water, Aquifers, Springs, Quaternary period, Observation wells, Analytical techniques, Water properties, Watershed management, Rivers.
Identifiers: *Romania, Craiova water supply, Jiu River.

The geology and hydrogeological conditions of the Jiu River basin are described as they relate to the water needs of the rapidly growing industrial city of Craiova, Romania. A comprehensive study was made that included measurements of springs and rivers, estimating seepage and underflow, drilling and experimentally pumping of test wells, analyzing selected water samples, and mapping of geologic units. Sands and gravels in Quaternary and Pliocene formations contain the only available groundwater which, however, is generally insufficient and of such inferior quality that it will not meet the needs of the city and surrounding area. The needs total 1.77 cu m/sec. Alternatives were considered that led to the conclusion that a dual water source would be necessary: (1) utilizing the underflow of the Jiu River floodplain and (2) development of the Karstic springs in the Vilcan Mountains. Quality of the Izuarna-Coetenigroup of springs is among the best in Romania. Water from the two sources will furnish Craiova City until 1985. (Lang-USGS)
W69-09287

PLANNED UTILIZATION OF GROUNDWATER BASINS: STUDIES CONDUCTED IN SOUTHERN CALIFORNIA,
California Resources Agency. Dept. of Water Resources.
Robert Y. D. Chun, Ernest M. Weber, and Kiyoshi W. Mido.
Int Ass Sci Hydrol, Symp Haifa, p 426-434, March 1967. 9 p, 2 fig.

Descriptors: *Mathematical models, *Simulation analysis, *Groundwater basins, *Water distribution, *Comparative costs, Natural resources, Digital computers, Water resources development, Hydrologic data.

A non-linear mathematical model was utilized to simulate the dynamic behavior of a groundwater basin. The study was carried out for the purpose of developing physically feasible plans of basin operation to provide water to the consumer at the lowest cost with no deterioration of natural resources. Comprehensive geologic, hydrologic and o tional-economic studies provided the data a general purpose digital computer was used t the model. The general procedures for setting model network and model parameters were g An on-line digital plot technique, which developed to provide rapid output to sim model testing, was described. A verified mod the groundwater basin made it possible to ac reliable results for evaluation of both the phy feasibility and comparative costs of a wide ran management plans. A general purpose meth determining the most economical coordinati surface and underground water supplies and f ties was the final result of the study. (Thiuri-nell)
W69-09372

SYSTEMS ENGINEERING AND AQUI MANAGEMENT,
Technion - Israel Inst. of Tech., Haifa.
For primary bibliographic entry see Field 06A.
W69-09373

CONSTRUCTION OF WELLS AND WA WORKS.

Ill Ann Stat ch 24, sec 11-125-1 (Smith-1962).

Descriptors: *Illinois, *Cities, *Water su *Water wells, Water conservation, Water man ment (Applied), Artesian wells, Water sou Drilling, Pumping, Well regulations, Regula Pumps, Waterworks, Construction costs, Cist Costs, Water loss, Water pollution, Pollution a ment, Legislation, Water pollution control, L aspects.

The corporate authorities in any city or vi may: (1) provide for the water supply by borin tesian wells or by digging, constructing or reg ing wells, pumps, cisterns, reservoirs, or w works; (2) borrow money therefor; (3) auth persons to bore, dig, construct and maintain same for a period not exceeding 30 years; prevent the unnecessary waste of water; prevent the pollution of water; and (6) preven juries to such wells, pumps, cisterns, reservoi waterworks. (Shevin-Fla)
W69-09438

4C. Effects on Water of Man's Non-Water Activities

STIGALL V SHARKEY COUNTY (SUIT DETERMINE JURISDICTION O HIGHWAY WHICH HAD CAUSED FLO ING).
42 So 2d 116-120 (Miss 1949).

Descriptors: *Mississippi, *Local governm *Road construction, *Jurisdiction, Highw Drainage systems, Overflow, Federal jurisdic State jurisdiction, Paving, Graded, Culv Drainage, Ditches, Surface waters, Flood dam Obstruction to flow, Drainage engineering, L aspects, Judicial decisions.

Plaintiff brought this suit against defendant co to recover damages to his crops caused by over of water resulting from improper construction road. Plaintiff charged defendant with the negli and wrongful acts of filling up an existing drai canal and the construction of a road bed upon fill. Plaintiff alleged that defendant placed cul under this road which were inadequate to carry normal flow of water. The issue raised before court was whether the county had jurisdictio the road. If it did have jurisdiction, it woul responsible for the alleged damages caused. question arose since the state highway departm provided a survey of the road and other aid i construction, while the federal government

led plans and man power through the WPA. The urt held though, in that all work was done with unty permission, the county had jurisdiction of e road and would be liable for all crop damage sulting from negligent construction of this road. ogan-Fla)
69-09070

IE FLORENCE FLOODS,
rmont Univ., Burlington. Dept. of Botany.
r primary bibliographic entry see Field 02E.
69-09132

DUISVILLE WATER CO INC V BOSLER ORT LIABILITY FOR WATER DAMAGES OM BROKEN CONDUITS).

3 SW-2d 105-109 (Ky 1968).

scriptors: *Kentucky, *Conduits, *Rupturing, amages, Compensation, Judicial decisions, ater supply, Pipelines, Sewers, Soil structure, Soil nsity, Soil-water relationships, Cities.
ntifiers: *Tort liability, *Foundations, Actual tice, Implied notice.

aintiffs sought damages for water damage to their rchandise allegedly caused by defendant water mpany's negligence in allowing one of its water ins to break. Seven other breaks had occurred in fendant's pipes at the downtown intersection in estion. Defendant's superintendent testified that e company was aware of the terrible condition of wers below the pipes, which might affect the undation under the pipes. On the evidence, the y awarded pl aintiffs $7,834.69 damages. On ap-al by defendant, the court of appeals of Ken-cky held plaintiff did not have the burden of oving a defect in the particular section of pipe ich broke. The court felt the evidence sufficient go to the jury where previous breaks and owledge of conditions might reasonably have put fendant on notice of possible future breaks if no medial precautions were taken. (Harris-Fla)
69-09407

ABILITIES OF TOWNS FOR DAMAGES AUSED BY INADEQUATE BRIDGES OR CUL-ERTS.

Stat Ann tit 19, secs 1371-1396 (1968).

scriptors: *Vermont, *Bridge failure, amages, *Construction, Culverts, Legal aspects, gislation, Bridges, Bridge construction, Repair-, Local governments, Boundaries (Property).

rsons sustaining injury or property damage by ason of the insufficiency or want of repair of a dge or culvert may recover damages in a tort ac-n against the town responsible for its upkeep. If o or more towns are jointly responsible, recovery y be had against both. Total damages may not ceed $3,000 or the amount of insurance carried, ichever is greater. If two or more towns are lia- and one is outside the state, the town or towns hin the state are proportionately liable. covery may not be had if the injured party was ing in violation of the law or exceeding the ight limitations for the bridge or culvert. The tute sets forth the required procedure for initiat- a claim. (Kelly-Fla)
69-09418

0). Watershed Protection

ATERSHED CONSERVATION DISTRICTS.
Code Ann, secs 63-171 thru 63-191 (Supp 68).

scriptors: *South Carolina, *Watersheds asins), *Water conservation, *Administrative ncies, Project planning, Water resources velopment, Water utilization, Water districts, gislation, Soil conservation, Soil erosion, Flood protection, Disposal, Land tenure, Soil management, State governments, Financing, Programs.
Identifiers: Water conservation districts.

Watershed conservation districts may be established as herein provided within one or more soil and water conservation districts for the purpose of developing and executing plans and programs relating to any phase of the control and prevention of soil erosion or flood prevention, the conservation, development and utilization of soil and water resources and the disposal of water. This authority is applicable to, but not limited to, the planning and carrying out of works of improvement for the above purposes. Certain procedures shall be followed in setting up the district. The procedures include petitioning by landowners to set up the district. Supervisors shall be appointed and a referendum held on the establishment of the district. The governing body shall consist of five directors elected as provided herein. The district shall be a governmental subdivision of the state and shall exercise public powers as provided herein. The district may issue bonds and levy taxes for payment thereof. Procedures are set up for collecting taxes, annexing lands, and discontinuing the district. (Heckerling-Fla)
W69-09102

REVEGETATION PROCEDURES FOR IMPROVEMENT OF THE SAN SIMON WATERSHEDS,
Arizona Univ., Tucson. Dept. of Watershed Management.
Gilbert L. Jordan.
Internat'l Conf. on Arid Lands in a Changing World, Arizona Univ., Tucson, June 3-13, 1969. 3 tab, 8 p.

Descriptors: *Watershed management, *Revegetation, Arizona, Arid lands, Arid climates, Yield, Sheetflow surface runoff, Valleys, Drought resistance, Alteration of flow, Brush control, Erosion control, Habitat improvement, Plant groupings, Deserts, Soil moisture, Deep tillage, Range management, Vegetation regrowth, Grasses, Ranges.
Identifiers: San Simon Valley (Ariz), Lehmann Lovegrass.

The San Simon Valley of southeastern Arizona is a frail watershed subject to excessive erosion and channel development. More than half of the annual precipitation of 9.5 in. occurs as torrential thunderstorms during the summer. Present cover consists of various communities of Sonoran and Chihuahuan desert shrubs. Shrubs frequently outcompete grasses for the limited soil moisture, exposing areas of bare soil. The first requirement for revegetation was adequate shrub removal; several methods were evaluated: Chained or bull dozer-cleared areas of creosotebush attained 75% of original growth in 4 yr. (sand dune mesquite 75% in 2 yr.). June was more effective than March for chaining. Adequate brush control could be had only by root plowing or disk plowing. Attention was also given to concurrent seedbed preparation and modification, type of seedbed, time of seeding and method of seeding. With Lehmann lovegrass, broadcasting has been as effective a means of planting as drilling. March seeding was much more successful than June in 1968, while in other years there was little difference. Disk plowing was constantly better than root plowing and both were better than chained and pitted seedbeds. Of several other species of Eragrostis studied, the most promising was Boer lovegrass E. curvula var. conferta. Substantial increases in yield were obtained from pitting of plowed seedbeds. Forage yields of 800-1500 lbs/acre were achieved on the better sites, along with runoff prevention. (Sherbrooke-Ariz)
W69-09205

CHEREVKOVSKOY WATER-MEADOWS OF THE NORTH DVINA VALLEY. I. NATURAL CONDITIONS (RUSSIAN),
Leningrad State Univ. (USSR).
L. N. Alekseyenko, and N. A. Frantskevich.
Vestnik, Leningr Univ, No 24, Geol-Geogr, Issue 4, p 135-146, 1968. 12 p, 3 fig, 28 ref.

Descriptors: *Flood plains, *Rivers, Topography, Erosion, Geomorphology, Microclimatology, Hydrologic properties, Vegetation, Animal populations, River basins, Water sources, Climates, Ice, Seasonal, Water level fluctuations, Groundwater, Geology, Structural geology, Lakes.
Identifiers: *USSR, Northern Dvina water-meadows.

The present topographical, geological and floral conditions of the Cherevkovskoy water-meadows are described and the hydrological regime of the Northern Dvina and its effect on the geomorphology and soil-forming processes of the river's water-meadows are analyzed. The variety of ecological conditions and the effect of man-made activities are also discussed. (Gabriel-USGS)
W69-09292

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

RAPID PHOSPHATE DETERMINATION BY FLUORIMETRY,
Missouri Univ., Columbia. Dept. of Chemistry; and Oak Ridge National Lab., Tenn. Div. of Analytical Chemistry.
John C. Guyon, and Wilbur D. Shults.
J Amer Water Works Ass, Vol 61, No 8, p 403-404, Aug 1969. 2 p, 3 fig, 3 ref.

Descriptors: *Analytical techniques, Chemical analysis, *Phosphates, *Fluorometry, Pollutant identification, Water chemistry, Water quality.
Identifiers: Phosphate analysis.

To measure phosphate contamination, two similar fluorometric procedures are offered, one for low concentrations and one for high. The methods proposed were evaluated by adding known amounts of phosphate to volumetric flasks and carrying out the analysis as described in the recommended procedures. An average relative error of 1-5% was observed for the one system, and 2% for the other. These suggested methods provide survey techniques for phosphate determinations over a wide range of concentrations. The methods are manipulatively simple, and should be readily adaptable to field survey or to conventional or automated laboratory situations. (Knapp-USGS)
W69-09137

FIGHTING WATER POLLUTION.
Performed Line Products Co. of Cleveland, Ohio.

Under Sea Technol, Vol 10, No 5, p 46-47, May 1969.

Descriptors: *Water pollution, *Buoys, *Lake Erie, Temperature, Waves (Water), Wind velocity, Turbidity, Turbidity currents, Bottom sediments, Conductivity, Light intensity.
Identifiers: Lake Erie buoy system, Water pollution monitoring.

A buoy system developed by the Preformed Line Products Co. of Cleveland, Ohio was tested by mooring this sytem in Lake Erie five miles north of Cleveland. The system is being designed to measure acidity of the water, temperature variation and gradient, wave height and frequency, wind speed, wind direction, turbidity, conductivity, bottom sediments, and penetration of light at various depths and times. (Gabriel-USGS)
W69-09147

METHODOLOGY OF HYDROCHEMICAL INVESTIGATIONS (RUSSIAN).
Akademiya Nauk SSSR, Leningrad. Gidrokhimicheskii Institut.
For primary bibliographic entry see Field 02K.
W69-09152

DISTRIBUTION OF METHANE AND CARBON MONOXIDE BETWEEN THE ATMOSPHERE AND NATURAL WATERS,
Naval Research Lab., Washington, D.C.
For primary bibliographic entry see Field 02K.
W69-09230

DETERMINATION OF PHOSPHATE IN NATURAL WATERS BY ACTIVATION ANALYSIS OF TUNGSTOPHOSPHORIC ACID,
Bureau of Commercial Fisheries, Ann Arbor, Mich. Biological Lab.; and Wayne State Univ., Detroit, Mich. Dept. of Chemistry.
For primary bibliographic entry see Field 02K.
W69-09232

A HORIZONTAL WATER SAMPLER FOR INVESTIGATION OF STRATIFIED WATERS,
Wisconsin Univ., Milwaukee. Center for Great Lakes Studies.
For primary bibliographic entry see Field 02H.
W69-09257

SENSORS FOR THE ANALYSIS AND CONTROL OF BIOLOGICAL PROCESSES,
Metropolitan Sanitary District of Greater Chicago, Ill. Research and Development Lab.
David R. Zenz, Timothy J. McAloon, and Clark L. Weddle.
Proc Amer Chem Soc Symp on Water, Air, and Waste Chem, Apr 13-18, 1969, Minneapolis, Minn, 1969. 41 p, 12 fig, 2 tab, 22 ref, 1 append.

Descriptors: *Sewage treatment, *Monitoring, *Sampling, *Measurement, *Instrumentation, Research and development, Mathematical models, Control systems, Activated sludge, Anaerobic digestion, Biological treatment.
Identifiers: Sewage treatment monitoring.

Available and experimental instruments for monitoring activated sludge and anaerobic sewage treatment processes are surveyed. The main difficulty encountered with most instruments is fouling of the sensor process lines and other equipment in contact with the samples. This fouling is primarily caused by grease and solid accumulations which result in excessive maintenance and recalibration. These problems in many instances can be minimized by homogenization of the sample stream before analysis and making provisions for automatic flushing of the instrument. Instruments to measure pH, temperature, dissolved oxygen and sludge level have been satisfactorily applied on a continuous basis. The Chicago Metropolitan Sanitary District is presently employing temperature, dissolved oxygen and sludge level detection instruments to automatically control some aspects of biological treatment. In addition, treatment plants can be operated with the aid of advanced computer techniques in conjunction with improved mathematical models that accurately describe the behavior of these processes. This type of advanced system could also have instant readout of the operating and analytical parameters and a memory bank capable of storing historical data for process investigation. (Knapp-USGS)
W69-09265

ON BICARBONATE DETERMINATION IN NATURAL WATER (ROMANIAN),
For primary bibliographic entry see Field 02K.
W69-09289

PROBLEMS OF THE CHEMISTRY OF NATURAL WATERS OF THE SOVIET UNION AND METHODS SUITABLE FOR THEIR ANALYSIS (RUSSIA N).
Akademiya Nauk SSSR, Leningrad. Gidrokhimicheskii Institut.
For primary bibliographic entry see Field 02K.
W69-09291

A RAPID METHOD FOR ESTIMATING RADIUM AND RADON IN WATER,
Bhabha Atomic Research Centre, Bombay (India). Air Monitoring Section.
D. N. Kelkar, and P. V. Joshi.
Health Physics, Vol 17, p 253-257, 1969. 5 fig, 2 tab, 4 ref.

Descriptors: *Radium radioisotopes, *Estimating, Temperature, Hydrogen ion concentration, Thermal springs, Radioactivit y, Groundwater, Lead radioisotopes, Sampling.
Identifiers: *Radon, Zinc sulfide scintillation powder, Barium, India, Bombay, Concentrations, Alpha activity, Bismuth, Polonium, Photomultiplier scaler, Thickness.

A rapid method for estimating radium and radon in water samples with activity levels more than 1-2 picocuries per liter, is described. Radium and daughter products of radon are precipitated with more than 95% efficiency in the presence of zinc sulfide (silver) scintillation powder giving a composite scintillator-sample combination. Apart from being rapid and inexpensive, the method is suitable for field use as it requires little apparatus and does not involve laborious chemical analysis. It is based on the co-precipitation of radium, and lead, bismuth and polonium with barium (as carrier) in the presence of zinc sulfide (silver) powder. Effects of temperature, hydrogen ion concentration, and amount of zinc sulfide (silver) were studied and conditions for optimum yield were determined experimentally. Excessive thickness of the sample affected counting. The overall eff iciency of the method, including geometry, is 68%; other conventional methods (excluding the emanation method) is seldom more than 45-48%. This method, though less sensitive than the more conventional methods, is quick, inexpensive and gives fairly good accuracy. Results of radium and radon levels in thermal springs measured in the field using this method, are tabulated. (Jones-Wis)
W69-09336

5B. Sources of Pollution

COOLING POND DESIGN IN THE SOUTHWEST,
Ebasco Services, Inc., New York.
T. J. Cotter, and A. W. Lotz.
Journal of the Power Division, Proceedings of the ASCE, Vol 87, No PO2, p 85-103, July 1961. 17 p, 13 fig, 1 tab.

Descriptors: *Thermal pollution, *Water conservation, *Engineering structures, *Cooling towers, Water resources, Non-consumptive use, Topography, Hydrologic data, Intake gates, Water discharge, Wells.
Identifiers: *Southwest, *Cholla Plant, *Four Corners Plant, Cooling pond design, 'Hot pond' concept.

The use of cooling ponds as a source of circulating water for central steam-electric stations is (in 1961) steadily increasing in the United States. The pond design for greatest effi ciency in heat dissipation must consider pond depth, intake depth, separation of intake and discharge, and make-up water supply. Although formulae and heat balances have been developed, judgment factors based on experience with varying physical characteristics under different climatological conditions are more critical in the design. These considerations are discussed in detail with reference to ponds at the Cholla and the Four Corners Plants in New Mexico. (Sherman-Vanderbilt)
W69-09031

PREDICTION OF TEMPERATURE IN RIVE AND RESERVOIRS,
California Univ., Berkeley. Civil Engineering De
Jerome M. Raphael.
Journal of the Power Division, Proceedings of t ASCE, Vol 88, No PO2, p 157-181, July 1962. p, 8 fig, 6 tab.

Descriptors: *Water pollution effects, *Tempe ture control, *Climatological data, *Ener Budget, Thermal pollution, Heat balance, Te perature distribution, Heat transfer, Solar rad tion, Thermocline, Evaporation.
Identifiers: *Temperature prediction, Short wa radiation, Back radiation, Lake Hefner.

A procedure is presented for predicting the te perature of various water bodies from weat records, inflow and outflow characteristics, and t surface area and volume of the body of water. T method can be applied to shallow lakes, flowi streams, and detention reservoirs, in which t thermocline is absent and the water is so stirred wind or current that temperatures are uniform. T heat-flow problem is reviewed and the essent equations are derived. An evaluation is made of t effect of atmospheric conditions such as air te perature, relative humidity, cloud cover, wi speed, and barometric pressure on short-wave i solation and reflectance, long-wave radiation fr atmosphere and water, evaporation, conductio and advection. Sources of climatological data a examined. A numerical procedure is described which all these effects are combined for a sh time increment and a complete heat balance o tained yielding the temperature change of the bo of water during the interval. An example is given the use of the method, which is easily adaptable machine computation. The method should find a plication in the comparison of temperature streams with and without detention reservoirs a in the dissipation of heat from industrial sources streams and lakes. (Sherman-Vanderbilt)
W69-09032

THERMAL POLLUTION OF WATE SYSTEMS,
Rutgers - The State Univ., New Brunswick, N.J.
Burton Davidson, and Robert W. Bradshaw.
Environmental Science and Technology, Vol 1, N 8, p 618-630, Aug 1967. 13 p, 8 fig, 14 ref.

Descriptors: *Thermal pollution, *Simulation an ysis, *Dissolved oxygen, *Biochemical oxygen d mand, *Water resources development, *Optimiz tion, Mathematical models, Temperature contr Analog models, Hydrologic data, Water pollut sources.
Identifiers: Enthalpy balance, Temperature index

The temperature pollution index to be establish must satisfy both law enforcement agencies a water users. Literature on thermal pollution reviewed and related t o a mathematical simulat model of BOD and DO content. The DO factor used to derive an optimal temperature in a pollut stream through a series of pollution-purificati balance equations. These analyses have be restricted to slowly-moving, medium-sized strea under summer conditions with idealized plug fl velocity. The optimization problems have three el ments: continuous, deterministic performan equations (BOD-DO equation) and initial or bou dary conditions; a piece wise continuous decisi vector function and constraints (stream temper ture, 0 deg C to 60 deg C; an objective functi (maximization of stream DO). Temperatu profiles are presented in the paper. (Sherman-Va derbilt).
W69-09039

THE EFFECT OF TEMPERATURE ON TH DEOXYGENATION OF A POLLUTED ESTU RY,
Public Health Service, Philadelphia, Pa. Delawa Estuary Comprehensive Study.
For primary bibliographic entry see Field 05C.
W69-09044

THE AVAILABILITY OF GROUNDWATER FOR COOLING PURPOSES (DUTCH),
Rijksinstituut voor Drinkwatervoorziening, Delft (Netherlands).
J. C. van Dam.
De Ingenieur, Algemeen Gedeelte 51, Jrg 80, p A743-A749, Dec 20, 1968. 7 p, 1 fig, 5 tab, 6 ref.

Descriptors: *Thermal pollution, *Applied water management, *Groundwater, *Water resources development, *Water discharge, *Water utilization, Natural recharge, Sludge disposal, Groundwater movement.
Identifiers: Netherlands.

The paper deals with conditions in the Netherlands. After a review of the occurrence of fresh, saline and brackish groundwater, information is given on the natural recharge and the safe yield of the fresh groundwater. The future water requirements for population and industry are far in excess of the safe yield of the fresh groundwater. Therefore, in general, fresh groundwater should not be withdrawn for cooling purposes exclusively, unless it is returned into the underground after use. Abstraction of saline and brackish groundwater generally does not meet with hydrological difficulties, however disposal of this water in fresh surface-water is unacceptable. THEREFORE AFTER USE IT SHOULD EITHER BE DISCHARGED INTO THE SEA, BY PIPELINE, OR BE RETURNED INTO THE UNDERGROUND. Finally some considerations are given on the increase of the groundwater temperatures in case warmed-up water is returned into the underground. Higher temperatures stand in the way of other abstractions for cooling. The final groundwater temperatures are reached after several years only. (Sherman-Vanderbilt)
W69-09048

THE RAPID THERMAL DIFFUSION OF STEAM STATION COOLING WATER DISCHARGE INTO RESERVOIRS,
Duke Power Co., Charlotte, N.C. Environmental Research.
J. Ben Stephenson.
Proceedings - Sixteenth Southern Water Resources and Pollution Control Conference, p 98-108, 1967. 11 p, 11 fig.

Descriptors: *Thermal pollution, *Water pollution effects, *Water chemistry, *Water treatment, *Temperature control, *Cooling water, Electric power plants, Thermal stratification, Dissolved oxygen, Water resources development, Limnology, Heat flow.
Identifiers: Thermal stability, Thermal behavior, Marshall Steam Station, Thermal diffusion.

The effect of temperature on other aquatic environmental factors is investigated, the dissolved oxygen content in particular, and related to water resources research and development (Marshall Steam Plant). Data from continuous testing (successive stations in a canal) of thermally stratified and thermally stable conditions of the reservoir is given in figures which relate temperature effects to dissolved oxygen content. One benefit found was that normally stagnant water from the bottom of the reservoir becomes exposed to the atmosphere and absorbed more oxygen. The lake observations of the discharging process indicate that water quality and other ecological factors are not impaired by the cooling waters. Generally, the temperature effects are limited because the discharged heat is rapidly diffused in the lake. Improved fishing conditions is one of the actual benefits which is cited. (Sherman-Vanderbilt)
W69-09050

RELATION OF PHOSPHATES TO EUTROPHICATION,
North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 05C.
W69-09135

LINDANE ADSORPTION BY LAKE SEDIMENTS,
Wisconsin Univ., Madison. Dept. of Soils.
Erik G. Lotse, Donald A. Graetz, Gordon Chesters, Gerhard B. Lee, and Leo W. Newland.
Environ Sci and Technol, Vol 2, No 5, p 353-357, May 1968. 5 p, 4 fig, 3 tab, 12 ref. OWRR Proj No B-008 Wis.

Descriptors: *Pesticide residues, *Sediments, *Lakes, *Adsorption, Path of pollutants, Clays, Silts, Chlorinated hydrocarbon pesticides, Water pollution sources, Pesticide kinetics.
Identifiers: *Lindane.

Lindane adsorption was determined on eight intact lake sediments using a radio-chemical technique. Lindane adsorption was shown to be affected by sediment suspension concentration, organic matter content, lindane concentration, clay content, and lindane-to-sediment ratio and to fit Freundlich's equation. As the lindane molecule is neutral and not subject to ionization, van der Waals forces and hydrogen bonding were considered the most feasible adsorption mechanisms. (Knapp-USGS)
W69-09167

CHEMICAL CONTAMINANTS FOUND IN SURFACE AND SUBSURFACE WATER AS RELATED TO SOIL AND CLIMATIC CONDITIONS.
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W69-09228

CHLORINATED INSECTICIDES IN RUNOFF WATER AS AFFECTED BY CROP ROTATION,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W69-09229

SOME GUIDELINES FOR REMOTE SENSING IN HYDROLOGY,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07B.
W69-09241

THE EFFECT OF CATION EXCHANGE CAPACITY ON THE RETENTION OF DIQUAT AND PARAQUAT BY THREE-LAYER TYPE CLAY MINERALS: 1. ADSORPTION AND RELEASE,
North Carolina State Univ., Raleigh. Dept. of Soil Science.
S. B. Weed, and J. B. Webber.
Soil Sci Soc Amer Proc, Vol 33, No 3, p 379-382, May-Jun 1969. 4 p, 4 fig, 2 tab, 11 ref.

Descriptors: *Adsorption, *Herbicides, *Clay minerals, Soil chemical properties, Organic compounds, Montmorillonite, Magnesium, Potassium, Calcium, Ion exchange, Diquat, Paraquat, Path of pollutants.
Identifiers: Vermiculite.

Diquat and paraquat were equilibrated for thirty minutes with suspensions of three-layer clay minerals varying in CEC from about 1 to 1.6 meq/g. Maximum adsorption of the divalent organic cations, expressed as % of CEC, decreased from 100% for montmorillonite (CEC= 1.03 meq/g) to 13% for a K -depleted muscovite (CEC= 1.63 meq/g). The exchangeable inorganic cation initially present markedly affected adsorption of diquat and paraquat by vermiculite but had much less effect on adsorption by montmorillonite. The order of adsorption was Na -vermiculite is greater than Ca -vermiculite is greater than or equal to Mg -vermiculite. Less than 15% of the adsorbed diquat or paraquat was released from montmorillonite by a single equilibration with approximately five symmetry of 0.005N chloride salt solutions of Al, Ca, Mg, or K. Similar treatment of vermiculite released up to 70% of the adsorbed organic cation, the order of release being from largest to smallest, Al, Ca, Al, for paraquat. Three successive treatments of vermiculite released up to 89% of the diquat or paraquat. (Knapp-USGS)
W69-09249

WARM-WATER IRRIGATION: AN ANSWER TO THERMAL POLLUTION,
SCIENCE, Washington, D.C.
Luther J. Carter.
Science, Vol 165, No 3892, p 478-480, Aug 1, 1969.

Descriptors: *Thermal pollution, *Nuclear power plants, *Waste-water disposal, Irrigation water, Public utilities, Nuclear wastes, Water utilization.
Identifiers: *Oregon, *Willamette Valley, Heated soil.

Two utility-financed projects for the agricultural use of heated waste-water are operating in Oregon. The warm-water discharge enhances plant growth and protects fruit trees from frost on a 170-acre tract (Willamette Valley) where plans are being made to experiment with an underground warm-water pipeline. A simulation has begun and been successful in the growth of corn on a 2-acre plot (Oregon State University). The utility investment in the farm was $475,000. A $2.6 million project has been drafted by the AEC but is not yet funded. Warm-water irrigation plans are appropriate in the Northwest because: (1) There are many acres of irrigable land; (2) There are many valuable fisheries in the rivers and restriction on river water use; (3) Tower and lake construction is expensive and unsightly compared to agricultural proposals. The findings are encouraging although limited and inconclusive. Professors at the University of Oregon warn that warm-water irrigation does not use the constant supply of effluent water, that it could be a health hazard, and presents research problems best handled by a university. (Sherman-Vanderbilt)
W69-09301

TEMPERATURE ANALYSIS OF A STREAM,
M. R. Collings.
Geological Survey Research, p 174-179, 1969. 5 fig, 2 tab, 6 ref.

Descriptors: *Temperature, *Streams, Meteorological effects, Water quality, Fourier analysis, Aquatic environment.
Identifiers: Chehalis River, Spot Water-temperature data, Hatcheries, Monthly maximum temperatures.

Temperatures of a stream were fitted and defined by a harmonic analysis of the probable occurrence, at the 95-percent level, of maximum and minimum monthly temperatures and of median temperatures throughout the year. The 0.5-probability curve of maximum temperatures was found to have equivalent values of amplitude and phase angle to that of a curve fitting 9 years of monthly maximum temperatures. Investigations also were made to determine the acceptability of using spot-temperatures throughout the year. A comparison, by regression analysis, of the mean monthly temperatures, from the thermograph record, with the synthetically determined median monthly temperatures, from the spot measurements, showed a standard error of 1.6 deg C. Another comparison, between the average harmonic curve from 4 years of spot measurements and the median curve from the maximum and minimum monthly temperatures, showed a standard error of 0.9 deg C. (Ross-Vanderbilt)
W69-09305

DIFFUSION OF COOLING WATER DISCHARGE FROM MARSHALL STEAM STATION INTO LAKE NORMAN,
Duke Power Co., Charlotte, N.C.
R. Fred Gray, and J. Ben Stephenson.
ASCE National Meeting on Environmental Engineering, Power Division, Chattanooga, Tennessee, p 1-21, May 13-17, 1968. 12 fig, 1 tab.

Descriptors: *Cooling water, *Thermal pollution, *Thermal stratification, *Environmental effects, *Synoptic analysis, Meteorological data, Reservoir, Water discharge, Isotherms.
Identifiers: *Marshall Steam Station, *Lake Norman, Skimmer wall.

This article reports data and conclusions of field research on heat dissipation patterns at the Marshall Steam Station on Lake Norman. If temperature data and meteorological factors are known, then the cooling water diffusion can be monitored. The field site is described for which two units of 350 mw each operate. Special features in the dissipation process are a submerged skimmer weir and an inverted skimmer wall. Temperature profiles (several are shown) from the synoptic survey are representative of different seasons and meteorological conditions and show that distinct advantages result from the location on a large reservoir where bottom water can be used for condenser cooling. During the colder months, the heated water rises to the surface where it is cooled by air and wind, while in summer months, the use of cold bottom water for cooling results in discharge temperatures close to lake-surface water. Only a small part of the lakes cooling capacity is needed. A comprehensive three year study of biological conditions is planned. (Sherman-Vanderbilt)
W69-09307

MOVEMENT OF FALL-APPLIED NITROGEN IN SANDY SOIL,
Forest Research Lab., Maple (Ontario).
H. H. Krause, and W. Batsch.
Can J Soil Sci, Vol 48, p 363-365, Oct 1968. 1 fig, 8 ref.

Descriptors: *Nitrogen, *Leaching, Nitrates, Nitrification, Eutrophication, Cycling nutrients, Soils, Water pollution sources.
Identifiers: *Fall-applied fertilizer-nitrogen, *Sandy soil, Groundwater pollution.

A lysimeter experiment on a sandy soil indicated significant nitrification and leaching of added ammonium fertilizer occurring from September 20 to November 30. About 88% of the added fertilizer-nitrogen (112 kilograms/hectare of nitrogen as ammonium nitrate) was lost. Soil temperatures during the experiment were far below optimum for nitrification, and during the last half of the experiment, the soil froze repeatedly to depth of 5 centimeters. The results obtained indicated that fall applied fertilizer-nitrogen would be lost to the succeeding crop. (Keeney-Wis)
W69-09338

5C. Effects of Pollution

THERMAL REQUIREMENTS OF FISH - THREE DECADES OF STUDY, 1940-1970,
Fisheries Research Board, Nanaimo (British Columbia). Biological Station.
J. R. Brett.
Transactions of the Second Seminar on Biological Problems in Water Pollution, Robert A. Taft Sanitary Eng Center, p 110-117, 1959. 8 p, 5 fig, 33 ref.

Descriptors: *Temperature control, Acclimatization, Metabolism, Biology, Water supply, Aquatic environment, Thermal pollution.
Identifiers: Homeotherms, Environmental factors, Lipid structure.

Three decades of research (1940 to 1970) on temperature relations in fish, and cold-blooded animals generally, are discussed. Speculation on the trends in the next decade are made from a survey of current literature. Temperature acts in a variety of ways. It may kill, reduce activity, interact with other environmental factors, confine reproduction, and be a directing agent where a gradient exists. Differences between species in maximum temperature tolerance can be as great as 17 deg C (31 deg F), and, in overall tolerance, a difference factor of 2.7 times can separate the most tolerant from the least tolerant. Despite ability to withstand low temperatures, slow rates of acclimation appear to result in greater mortalities from cold in nature. Temperature controls the activities of fish by regulating rates of metabolism (resting and active). The numbing effects of low temperature restricting performance, or the equally restricting effects of high temperature demanding excessive body maintenance are of serious consequence for maintaining continuity of a species. Research on this aspect and the information made available is required if adequate thermal relations are to be prescribed for fish: In order to prescribe thermal requirements, limits to the 'safe' reduction of activity imposed by temperature are set forth as a basis for discussion. (Sherman-Vanderbilt)
W69-09030

MANAGING CLIMATIC RESOURCES,
Rand C orp., Santa Monica, Calif.
For primary bibliographic entry see Field 02B.
W69-09033

SWIMMING PERFORMANCE OF SOCKEYE SALMON (ONCORHYNCHUS NERKA) IN RELATION TO FATIGUE TIME AND TEMPERATURE,
Fisheries Research Board, Nanaimo (British Columbia). Biological Station.
J. R. Brett.
Journal of Fisheries Research Board of Canada, Vol 24, No 8, p 1731-1741, Aug, 1967. 11 p, 4 fig, 2 tab, 17 ref.

Descriptors: *Sockeye salmon, *Thermal pollution, Fresh-water fish, Metabolism, Temperature, Acclimatization, Aquatic environment.
Identifiers: *Swimming performance of fish, Fixed velocity effects, Temperature effects, Lethal temperatures, Fatigue testing.

Further studies on the swimming performance of fingerling sockeye salmon at fixed velocities have been conducted in relation to fatigue time. The method of probit analysis, commonly used in dealing with bioassay data, was found to be suitable for determining times to 50% fatigue and in providing a measure of variance despite the presence of some erratic behavior. For sockeye acclimated to 15 deg C (mean length= 13.6 cm) the velocity at which 50% fatigued was 54.4 cm/sec or 4.0 lengths/sec (L/sec). The 5% and 95% fatigue velocities were 3.1 and 4.8 L/sec, respectively. Larger fish required longer exposure times for determining maximum sustained speeds, extending from approximately 120 min for fingerlings to 500 min for adults. Using the method of increasing velocity steps the effect of temperatures from 5 to 27.5 C was examined. When acclimated to 15 C fingerling sockeye exhibited only a 4% reduction in swimming speed at 10 and 20 C. Temperatures above the lethal level caused a rapid decline in swimming ability approaching the extinction point at 27.5 C. Recommendations for standard procedures in the study of swimming speeds are made. (Ross-Vanderbilt)
W69-09034

THE EFFECTS OF TEMPERATURE AND WATER HARDNESS UPON THE TOXICITY OF NAPHTHENIC ACIDS TO THE COMMON BLUEGILL SUNFISH, LEPOMIS MACROCHIRUS RAF., AND THE POND SNAIL, PHYSA HETEROSTROPHA SAY,
Academy of Natural Sciences of Philadelphia, Pa.
John Cairns, Jr., and Arthur Scheier.
Notulae Naturae of the Academy of Natural Sciences of Philadelphia, No 353, p 1-12, May 15, 1962. 8 tab, 9 ref.

Descriptors: *Aquatic environment, *Temperature, *Hardness, *Sunfishes, Thermal pollution, Toxicity, Acclimatization, Snail.
Identifiers: Bluegill sunfish, Pond snail, Naphtenic acid, Oxygenation.

Literature dealing with the toxicity of naphthe
acids is briefly discussed. For fish, the concent
tion of naphthenic acids which resulted in 50% s
vival in 96 hours was 5.79 p.p.m. in soft water at
deg C, and 5.60 p.p.m. in soft water at 30 deg
7.15 p.p.m. in hard water at 18 deg C, and 7.
p.p.m. in soft water at 30 deg C; 12.6 p.p.m. in ha
water at 20 deg C, and 12.2 p.p.m. in hard water
30 deg C. (Sherman-Vanderbilt)
W69-09035

RESEARCH ON TEMPERATURE EFFECTS O FISHES,
Federal Water Pollution Control Administratio
Duluth, Minn. Nat ional Water Quality Lab.
Donald I. Mount.
Paper presented at the Eighth Annual Environme
tal and Water Resources Engineering Conferen
Vanderbilt Univ, p 1-14, June 5-6, 1969. 14 p.

Descriptors: *Thermal pollution, *Temperatu
control, *Environmental effects, *Water qual
control, Aquatic environment, Regional analys
Thermal stratification, Commercial fish, Sport fis
Food chai ns.
Identifiers: *National Water Quality Laborato
Yellow perch, White suckers, Northern pik
Brook trout.

Thermal pollution literature must be critically su
marized and experimental objectives must
selected before research will advance. The curre
interest in thermal pollution results from publiciz
concern and the easiness of measuring and co
trolling temperatures but disregards problems su
as thermal stratification, nonspontaneity of te
peratures, or climatic effects. Although water sta
dards have been recommended, optimum rath
than maximum zone temperatures should be us
to develop more curves of annual temperatu
regimes. Modification of the winter chill-period
the primary suggestion, and input balance is seen
an outmoded substitute for water treatment. S
objectives for the study reported are: A determin
tion of which species among thirty from the stu
list require a chill-period during the winter mont
to imitate reproduction; studies to determine t
critical periods in the life cycle of the desirable sp
cies and the temperatures required during the
critical periods; a determination of the temper
tures providing optimum growth for individual sp
cies; temperature requirements for food organisn
of the species that are known to be important or e
sential; an evaluation of the rate of temperatu
change that is acceptable for various species; veri
cation of laboratory-derived results in a semi-nat
ral situation where all elements of the ecosyste
must function together to produce a harvestab
fish crop. The final measure of temperature effe
will be the pounds-per-acre of fish produce
(Sherman-Vanderbilt)
W69-09036

THE RESISTANCE AND ACCLIMATIZATIO OF MARINE FISHES TO TEMPERATUR CHANGES. I. EXPERIMENTS WITH GIRELL NIGRICANS (AYRES),
Scripps Institution of Oceanography, La Joll
Calif.
Peter Doudoroff.
Biology Bulletin, Vol 83, No 2, p 219-244, 194
26 p, 5 fig, 4 tab, 29 ref.

Descriptors: *Thermal pollution, *Heat resistanc
*Cold resistance, Acclimatization, Ecolog
Marine fish, Variability, Fluctuation, Biology.
Identifiers: *Girella, Heat-coma, Chill-coma, Su
vival criterion, Time-temperature curve.

The resistance of young Girella nigricans (Ayre
to low and high temperatures and the changes
tolerance produced by acclimatization are e
amined. The fish were killed by moderately lo
temperatures, the lower limits of temperatu
tolerance being no more extreme, in comparis
with normal environmental temperatures, than t
corresponding upper limits. The relationsh
between the duration of exposure to the test te

tures and the upper or lower 'median tolerance
s' is representable by smooth time-tempera-
curves of tolerance. Acclimatization to dif-
nt temperatures has a pronounced influence on
orm of the respective time-temperature curves
olerance. Experiments on the rate of accli-
zation correlate the conclusion, based on earli-
bservations, that heat-resistance in fish is
ed rapidly after a rise of temperature and lost
ly after cooling. Acclimatization to cold is rela-
y slow, and cold-resistance is lost no more
ly than it is acquired. After a given change in
ronmental temperatures, about 50 percent of
otal resulting change in cold-tolerance occurs
wo days, and complete acclimatization is
eved within about twenty days. Injury by
ing is no less important as a possible limiting
or in the distribution of marine fishes than heat
y. Figures and tables show the collection and
elation of tolerance limits and acclimatization
tion data. (Sherman-Vanderbilt)
-09037

**RESISTANCE AND ACCLIMATIZATION
MARINE FISHES TO TEMPERATU RE
NGES. II. EXPERIMENTS WITH FUNDU-
AND ATHERINOPS,**
ops Institution of Oceanography, La Jolla,
r Doudoroff.
ogy Bulletin, Vol 88, No 2, p 194-206, 1945.
, 2 fig, 5 tab, 22 ref.

criptors: *Cold resistance, *Thermal pollution,
at resistance, *Acclimatization, Temperature
rol, Respiration, Dehydration, Salinity, Marine

tifiers: *Fundulus, *Atherinops, Heat-coma,
coma, Girella, Duration, Osmoregulative
re.

resistance of the hardy mari ne fish Fundulus
ipinnis and of the delicate Atherinops affinis to
and high temperatures is examined in relation
mperatures of previous acclimatization and to
erature conditions in the natural habitats of
ishes. The relationships between the time (du-
n) of exposure to test temperatures and the
age (median) limits of temperature tolerance
ate the value of prolonged tests in the study of
tance to cold and heat. Marked suscepti bility
arine fishes to chilling (i.e., injury at non-freez-
ow temperatures) and the influence of accli-
zation upon temperature tolerance are con-
ed. The death of Fundulus at slowly lethal low
eratures, but not at rapidly lethal tempera-
, is preceded in the normal medium (sea-
r) by evident dehydration of the tissues and is
ved by dilution of the medium. Osmoregulative
re is indicated as one of the causes of slow
n at low temperatures in seawater, but not of
l death at more extreme low temperatures,
h may be caused partly by respiratory
rbances. (Sherman-Vanderbilt)
-09038

**FERRED TEMPERATURE OF RAINBOW
UT (SALMO GAIRDNERI RICHARDSON)
ITS UNUSUAL RELATIONSHIP TO AC-
MATION TEMPERATURE,**
nto Univ. (Ontario). Lab. for Experimental
ology.
Garside, and J. S. Tait.
dian Journal of Zoology, Vol 36, p 563-567,
. 1 fig, 1 tab, 5 ref.

riptors: *Rainbow trout, *Thermal pollution,
atic environment, Temperature gradient,
graphy.
ifiers: Preferred temperature, Acclimation
erature.

purpose of this study was to determine the
ted or preferred temperature of the rainbow
, Salmo gairdneri Richardson, at various accli-
n temperatures. The preferred temperature
n generally has been found to be influenced by the temperature at which they are acclimated. The fish were reared at the laboratory from eggs supplied by the Provincial Fish Hatchery at Normandale, Ontario, in May 1955. The modal preferred temperatures of rainbow trout acclimated to 5 deg C, 10 deg C, 15 deg C and 20 deg C were determined photographically to be 16 deg C, 15 deg C, 13 deg C and 11 deg C, respectively. The final preferendum was 13 deg C. The phenomenon of decreasing preferred temperature with increasing acclimation temperature has not been reported for any other species of fish. (Ross-Vanderbilt)
W69-09040

ACCLIMATION TO TEMPERATURE IN THE MARINE COPEPOD, CALANUS FINMARCHICUS (GUNNER.),
Dalhouse Univ., Halifax (Nova Scotia). Inst. of Oceanography.
K. Halcrow.
Limnology and Oceanography, Vol VIII, No 1, p 1-8, Jan 1963. 8 p, 6 fig, 2 tab, 19 ref.

Descriptors: *Acclimatization, *Marine animals, *Copepods.
Identifiers: *Respiratory rate, Oxygen uptake, C. finmarchicus, Oxygen uptake overshoot.

C. finmarchicus has cosmopolitan distribution and is found in waters at -2 deg to 22 deg C. Test organisms were harvested with plankton tows (No. 000 mesh nylon net) from the coastal waters of Nova Scotia. Respiratory rate was determined with a modified oxygen electrode technique. Three acclimation rates were employed, 4 deg, 10 deg and 20 deg C. Copepods collected in March and April showed the highest respiratory rate at 10 deg, while those collected in August had the highest rate at 20 deg. In each case the lowest rate was at 4 deg. Overshoot of oxygen uptake was demonstrated when copepods were exposed to a sudden temperature change, i.e., oxygen consumption increased greatly in the first 2 hr and thereafter fell to a constant level in 4 hr. (Malaney-Vanderbilt)
W69-09043

THE EFFECT OF TEMPERATURE ON THE DEOXYGENATION OF A POLLUTED ESTUARY,
Public Health Service, Philadelphia, Pa. Delaware Estuary Comprehensive Study.
David H. Stoltenberg, and Matthew J. Sobel.
Journal of the Water Pollution Control Federation, Vol 37, No 12, p 1705-1715, Dec 1965. 11 p, 2 fig, 3 tab, 12 ref.

Descriptors: *Thermal pollution, *Water pollution effects, *Dissolved oxygen, *Biochemical oxygen demand, Sanitary engineering, Natural streams, Estuary sampling, Incubation, Organic loading, Bicarbonates, Phosphates, Chlorides.
Identifiers: *Delaware estuary, *Decay coefficient, Analysis of covariance, Temperature coefficient, Van't Hoff-Arrhenius formula, Sodium theosulfate.

A systems analysis technique has been presented for describing the space and time variations of dissolved oxygen (DO) in a body of water. The response of the water body system to the action of a 'forcing function' can be measured in terms of t he specific parameter, DO, which is affected by the biochemical oxygen demand (BOD). Because of a lack of sufficient data for K (deoxygenation constant) for the Delaware Estuary comprehensive study, the following work was done to determine its values in the estuary. The decay coefficient was related empirically to stream temperatures after the effect on the coefficient of organic matter concentration and other factors was tested. There are two sections: (1) a study of the effects of collection temperature, sampling location, tidal stage, and organic loading on K for various samples incubated at the same temperature; and (2) determinations of K as a function of incubation temperature. (Sherman-Vanderbilt)
W69-09044

SOME EXPERIMENTS UPON TEMPERATURE ACCLIMATIZATION AND RESPIRATORY METABOLISM IN FISHES,
Scripps Institution of Oceanography, La Jolla, Calif.
F. B. Sumner, and P. Doudoroff.
The Biological Bulletin, Vol 74, No 3, p 403-429, June 1968. 27 p, 7 fig, 9 tab, 19 ref.

Descriptors: *Respiration, *Metabolism, *Thermal pollution, *Aquatic environment, Potassium cyanide.
Identifiers: *Temperature acclimatization, *Gillichthys mirabilis, Cyanide, Boiled seawater, Lethal heat, Lethal cold, Urethane, Respiratory movements, Fish metabolism, Fundulus parvipinnis.

Fishes (Gillichthys mirabilis) having different temperature histories were subjected to KCN, to boiled seawater, and to temperatures high or low enough to be lethal. Urethane, an anesthetic, was used in a limited number of experiments. The time of death (or of anesthetization) was recorded for each of the fishes (nearly 3,000). Counts of respiration were made in numerous cases. Death in both KCN and i n boiled water was speedy in proportion to the temperature, the reciprocals of the times of death forming an approximate logarithmic series when plotted against temperature. The temperatures used were 10 deg, 15 deg, 20 deg, 25 deg, and 30 deg C. In the case of KCN, a low correlation was found to exist between the duration of previous acclimatization to high or low temperatures and the degree of resistance to KCN at those temperatures. When fishes which had been acclimatized to high (30 deg) and low (10 deg) temperatures were tested in KCN, boiled water or urethane at 20 deg, there was a consistent reversal in the resistance of the respective lots. Death in de-oxygenated seawater was more than 60 percent slower, at the same temperatures, than in KCN solution. Even though the size of the fish appeared to have little or no influence upon its resistance to lethal heat or to cyanide poisoning, it was found that smaller fishes had a more rapid respiratory rhythm, and succumbed more rapidly in boiled water than larger ones. (Ross-Vanderbilt)
W69-09045

BIOCHEMICAL EFFECTS OF COOLING-WATER DISCHARGE INTO PUBLIC WATERS (DUTCH),
Instituut voor Gezondheidstechniek TNO, The Hague (Netherlands).
J. K. Baars.
De Ingenieur, Gezondheids techniek, p G85-G88, Dec 20, 1968. 4 p, 3 fig, 4 tab, 1 ref.

Descriptors: *Thermal pollution, *Waste-water treatment, *Water pollution effects, Biochemical oxygen demand, Chemical properties, Cooling water, Reaeration.

'Thermal pollution' of a body of water, as being caused by the disposal of cooling water of higher temperature, has various aspects which - under certain conditions - can be detrimental to aquatic life as such. The form of the resulting oxygen sag curve is reviewed, with data from several sources shown. From the biochemical point of view the paper gives a condensed survey of the different factors active in this respect, and the eventual precautionary or remedial measures to be envisaged. (Sherman-Vanderbilt)
W69-09049

THE RAPID THERMAL DIFFUSION OF STEAM STATION COOLING WATER DISCHARGE INTO RESERVOIRS,
Duke Power Co., Charlotte, N.C. Environmental Research.
For primary bibliographic entry see Field 05B.
W69-09050

THE EFFECTS OF HIGH TEMPERATURES ON ROACH (RUTILUS RUTILUS) I. THE EFFECTS OF CONSTANT HIGH TEMPERATURES,
King's Coll., London (England). Dept. of Zoology.

Anthony W. Cocking.
The Journal of Experimental Biology, Vol 36, No 1, p 203-216, Mar 1959. 14 p, 4 tab, 4 fig, 36 ref.

Descriptors: *Thermal pollution, *Heat resistance, *Acclimatization, Temperature control, Fish physiology, Heated water.
Identifiers: *Rutilus rutilus, *Thermal relations, Fry, Median temperature tolerance, High lethal limit, Asphyxial concentration.

In a laboratory investigation a fairly hardy fish, Rutilus Rutilus (Roach), was tested for high lethal temperature limits and median thermal tolerance levels. These results and observations of behavior patterns were then compared to those of a fish with different eurythermal and stenothermal habits. The stages and symptoms of the fish after transferral to a constant higher temperature are described. The five stages with some variations are: period of no response, initial distress, recovery, final distress, loss of control, death or complete recovery. Data results included the following: (1) The temperature at which 50% of a sample of roach (Rutilus rutilus) die within a week cannot be raised above 33.5 deg C by raising the acclimatization temperature. (2) The mean asphyxial concentration of oxygen at 30 and 32 deg C is approximately 0.8 mg./1. (3) Median survival time at any lethal temperature increases with increase in acclimatization temperature; survival time for any acclimatization temperature decreases as test temperatures increase. (4) The behavior, on transfer to higher temperatures, depends on the acclimatization temperature and the size of the jump in temperature and can be divided into five characteristic stages. (Sherman-Vanderbilt)
W69-09051

THE EFFECTS OF HIGH TEMPERATURES ON ROACH (RUTILUS RUTILUS); II. THE EFFECTS OF TEMPERATURE INCREASING AT A KNOWN CONSTANT RATE,
King's Coll., London (England). Dept. of Zoology.
Anthony W. Cocking.
Journal of Experimental Biology, Vol 36, No 1, p 217-226, Mar 1959. 10 p, 5 fig, 1 tab, 12 ref.

Descriptors: *Aquatic environment, *Thermal pollution, *Fish behavior, Temperature, Acclimatization.
Identifiers: *Lethal temperatures, Roach (Rutilus Rutilus), Oxygen concentration effects, Ammonia effects, High temperature effects, Carbon dioxide effects.

Temperature effects on aquatic life are investigated in an environment where the temperature is rising at a constant rate. The following results were obtained: (1) When roach were acclimatized to 20 deg C and then subjected to five constant rates of temperature rise, the range of death temperatures depended on the interaction between the opportunity for acclimatization and the exposure to lethal temperatures. (2) At 1/20 deg C an hour rise in temperature, roach acclimatized fully, died over the longest temperature range (30.3-35/8 deg C) had the highest mean death temperature (32. deg C) and died over a disproportionate length of time (up to 88 hr.) when compared with other rates. The death temperature range at 1/10 deg C an hour was 30.8-32.0 deg C (mean 31.4 deg C) and at 8/10 deg C an hour was 31.5 to 32.9 deg C (mean 32.9 deg C). (3) Roach cannot acclimatize fully at rates faster than 1/20 deg C an hour though some acclimatization takes place at a rate of 8/10 deg C an hour. (4) Roach excrete more ammonia as the temperature rises but the increase depends on the rate of temperature rise and is delayed for up to 240 hr. at 1/20 deg C an hour. (5) The behavior showed characteristic changes. (6) Roach died from the posterior end forwards; the heart was beating and the gall bladder abnormal when the body was opened. (Ross-Vanderbilt)
W69-09052

FUTURE ASPECTS OF COOLING-WATER DISCHARGE BY ELECTRICAL POWER PLANTS (DUTCH),
Directie Waterhuishouding en Waterbeweging van de Rijkswaterstaat, Delft (Netherlands).
P. J. Wemelsfelder.
De Ingeni eur, Bouw-en Waterbouwkunde 15, p B179-B198, Dec 20, 1968. 10 p, 17 fig, 7 tab.

Descriptors: *Thermal pollution, *Water utilization, *Water resources development, *Cooling-water, *Electric power plants, Waste-water disposal, Water supply, Thermal properties.
Identifiers: *Netherlands, Cooling-water discharge, Natural water resources.

For the first electrical power plants in the Netherlands the availability of water for their cooling purposes did not give rise to any problem. The continuous increase of such plants, in numbers and capacities has introduced, however, the necessity of situating those new and bi gger plants in the vicinity of major bodies of water, in order to safeguard the cooling-water requirements and at the same time to keep the effects of discharge within acceptable limits. The still growing demand for electrical energy makes it inevitable to investigate the entire matter more profoundly. In the present paper a quantitative analytical treatment is given of the practical use of available natural water-bodies in the Netherlands in view of the future needs as to cooling purposes. (Sherman-Vanderbilt)
W69-09053

THERMAL ACCLIMATION AND TEMPERATURE SELECTION IN ATLANTIC SALMON, SALMO SALAR, AND RAINBOW TROUT, S. GAIRDNERI,
Carleton Univ., Ottawa (Ontario). Dept. of Biology.
M. Yaqub Javaid, and John M. Anderson.
Journal of Fisheries Research Board of Canada, Vol 24, No 7, p 1507-1513, July 1967. 7 p, 2 fig, 1 tab, 10 ref.

Descriptors: *Thermal pollution, *Aquatic environment, *Temperature gradient, Atlantic salmon, Rainbow trout.
Identifiers: *Thermal acclimation, Temperature selection.

The selected temperature for Atlantic salmon and rainbow trout, as determined in a horizontal gradient, increases with acclimation temperature over the acclimation range 5 to 20 deg C for salmon and 10 to 20 deg C for trout. The final preferendum for salmon is about 17 deg C. The results for rainbow trout suggest that the type of gradient used, i.e., vertical or horizontal, has a marked influence on the experimentally determined relation between acclimation temperature and selected temperature. The final preferendum for rainbow trout was not reached, evidently it is higher than 20 deg C. Five different groups of fish were tested for each species at each acclimation temperature. (Ross-Vanderbilt)
W69-09056

RELATIONSHIP OF TEMPERATURE TO TOTAL ANNUAL GROWTH IN ADULT SMALLMOUTH BASS,
Department of Lands and Forests, Picton (Ontario). Glenora Fisheries Station.
Daniel W. Coble.
Journal of Fisheries Research Board of Canada, Vol 24, No 1, p 87-99, Jan 1967. 13 p, 1 fig, 4 tab, 23 ref.

Descriptors: *Water temperature, *Growth rates, *Smallmouth bass, *Fish physiology, Thermal pollution, Aquatic environment.
Identifiers: South Bay, Lake Huron.

The purpose of this study was to find out if total annual growth of smallmouth bass, Micropterus dolomieui Lacepede, is related to temperature and, if so, what variation around the relationship e Two sets of information were used: original da two populations of smallmouth bass in Ontar which rather detailed information on growt temperature were obtained, and published da growth of smallmouth bass in various w throughout the North American range. Total y growth of smallmouth bass of ages 3-5 in S Bay, Lake Huron, and in several other widely tered populations was related to mean su water temperature for the period July through tember, more growth being associated with wa waters. The difference in the manifestation growth-temperature relationship appears t real, rather than a result of differences in da treatments of them, and indicates, therefore other factors may influence total annual grow much as, or more than, temperature. (Ross derbilt)
W69-09057

TEMPERATURE TOLERANCE OF SOME TARCTIC FISHES,
Stanford Univ., Calif. Dept. of Biological Scie
G. N. Somero, and A. L. De Vries.
Science, Vol 156, p 256-258, April 14, 1967. fig, 1 tab, 14 ref.

Descriptors: *Fish, Aquatic environment, Mo ty, Metabolism, Water pollution effects, Cold fish, Lethal limit.
Identifiers: *Temperature tolerance, Lethal peratures, Antarctic fishes.

Three species of Antarctic fishes which live in stantly near-freezing waters have a markedly upper-lethal temperature at 6 deg C; this wa lowest upper-lethal temperature reported fo organism. The fishes survived supercooling to deg C. Data on brain metabolism is vitro supp by the hypothesis that the central nervous sy was a primary site of thermal injury. It was also gested that thermal death may have resulted subtle biophysical changes in the cellular l perhaps the membrane lipids, rather than direct thermal destruction of enzyme func (Ross-Vanderbilt)
W69-09058

RELATION OF PHOSPHATES TO EUTRO CATION,
North Carolina Univ., Chapel Hill. Dept. o vironmental Sciences and Engineering.
Charles M. Weiss.
J Amer Water Works Ass, Vol 61, No 8, p 387 Aug 1969. 5 p, 2 fig, 4 tab, 22 ref.

Descriptors: *Eutrophication, *L *Phosphates, Nutrients, Algae, Water pollutio fects, Water pollution sources, Aquatic produ ty, Limnology, Plankton, Primary product Trophic level.
Identifiers: Lake Tahoe.

The relationship of phosphates in water to pri production is examined, and the phosphorus in natural lake biological systems is outl Although higher than normal macronutrient l will generally produce an increase in leve productivity or shift of trophic status, the sp interrelationships of each nutrient factor an ceedingly complex and remain unclear. The bi ical storage of phosphorus by algae in excess o mediate growth requirement, its secretion as ble organic phosphorus, and its reuse would ap to be a significant factor in satisfying nut levels, particularly for those species with phosphorus requirements. Increases in tro status are generally associated with invasio blue-green algae, which have capability nitrogen fixation with resulting enhancemen nitrogen levels and acceleration of the ra eutrophication. The rate of trophic respons each lake or reservoir to changes in macronut levels involves not only nutrient change, but the total chemical and physical characteristi the particular basin. The chemical nature o

ular phosphorus species, its association with dal or particulate materials and the specific iated phytoplankton all contribute to the rate ilization of the phosphate pool and thus the f eutrophication. (Knapp-USGS)
09135

MICAL AND MINERALOGICAL CHARAC-STICS OF EUTROPHIC LAKE SEDI-TS,
ecticut Agricultural Experiment Station, New n.
Frink.
Sci Soc Amer Proc, Vol 33, No 3, p 369-372, June 1969. 4 p, 3 fig, 2 tab, 21 ref.

riptors: *Sediments, *Eutrophication, *Water istry, Clay minerals, Nutrients, Nitrogen com-ds, Phosphorus compounds, Weathering, Lim-y, Lake soils, Mud.
ifiers: Sediment chemistry, Nutrient sources, ent storage.

led chemical and mineralogical analyses of ediments of a eutrophic lake revealed that of the characteristics usually associated with productivity increased considerably with in-ing depth of water. Thus, the center of the is enriched in clay, organic matter, N, and P compared with the sediments around the or the soils in the watershed. Most of the ges in physical characteristics are attributed to orting during transport and deposition within ke. A number of chemical changes also accur liment is transported from the acid watershed neutral lake environment. Chief among these ical weathering processes are the oritization of Al-interlayered vermiculite and bsequent conversion to illite, as well as a shift red phosphates from Al-P and Fe-P to Ca-P. these observations help to describe the ss of eutrophication and serve as a basis for er analysis of the nutrient-supplying ability of sediments. (Knapp-USGS)
09144

RADATION OF GAMMA - BHC IN SIMU-ED LAKE IMPOUNDMENTS AS AF-TED BY AERATION,
onsin Univ., Madison. Dept. of Soils.
Newland, G. Chesters, and G. B. Lee.
Water Poll Control Fed, Vol 41, part 2, p 174-May 1969. 25 p, 1 tab, 7 fig, 28 ref. OWRR 3-016-WIS.

riptors: *Biodegradation, *Insecticides.
ifiers: GAMMA-BHC, Isomerization, *Aera-ffects, *Simulated lake impoundment.

egradation of gamma-BHC in simulated aero-nd anaerobic lake impoundments was deter-l and anaerobic degradation was much more than aerobic degradation. In the aerobic ated lake impoundment, degradation of 15 nt of the added gamma-BHC occurred in hr and the isomer alpha-BHC was formed as egradation product. In the anaerobic im-lment some 90 percent of the added gamma-was degraded in the 2,100-hr incubation to the isomers alpha- and delta-BHC. se of the profound effect of oxygen on dation rates and the apparent 'lag phase' of action, it is concluded that the isomerization nma-BHC occurs by a biological mechanism. thermodynamic stability of benzene hex-ide isomers is in the order gamma-BHC< BHC< delta-BHC< beta-BHC. However, lization of gamma-BHC and alpha-BHC from poundments prevented the formation of the stable isomers, namely, delta- and beta-BHC gh in the later stages of degradation in the bic impoundment some delta-BHC was d. The isomerization leads to detoxification insecticide, e.g., the acute oral lethal dosage) for rats is 125 mg/kg body weight for a-BHC, 500 mg/kg for alpha-BHC and 6,000 for delta-BHC.
09227

STEAM-ELECTRIC POWER AND THERMAL POLLUTION,
Sports Fishing Inst.
R. H. Stroud.
SFI Bulletin, No 201, p 1-3, Jan-Feb, 1969. 3 fig.

Descriptors: *Thermal pollution, *Electric power plants, *Cooling towers, *Cooling ponds, *Wastewater treatment, Administration, Public utilities, Freshwater runoff.
Identifiers: *Closed circuit cooling.

Predicted and actual data displaying the danger to overheated streams of increasing steam electric station industries by heat discharge is reported as well as the available cooling facilities and a generalized cost for the process (estimate 3% of production cost). These systems are rated from least to most effective by the author as: once-through cooling (negligible effect), evaporative cooling towers (reduction of differential between heated discharge and intake temperatures to 1/2), cooling pond, closed circuit cooling, combinations. Thermal pollution is seen as within means of control with technology and administrative policy to be utilized when there is a public demand. Recent power company projects are described and those plants with immediate need for controlling measures are named. It is noted that a recent listing of conventional steam plants (of 500 mw or larger) 7 used cooling towers, 5 cooling ponds, 21 once-through cooling, and 14 did not report. Of 32 completed or planned nuclear facilities, 7 use cooling towers and the rest once-through cooling. Some details are presented for a few plants deemed adequate. (Sherman-Vanderbilt)
W69-09304

WATER USE AND THERMAL POLLUTION,
EG and G, Inc., Las Vegas, Nev.; and Reynolds Electrical and Engineering Co., Inc.
Frank C. Di Luzio.
Power Engineering, Vol 85, p 44-46, June 1968. 1 tab, 1 fig.

Descriptors: *Thermal pollution, *Water pollution effects, *Waste water disposal, *Water Quality Act, *Water pollution sources, Power plants, Waste water treatment, Water quality, Aquatic environment.
Identifiers: *National Power Survey, Nuclear breeder reactors.

Thermal pollution sources, effects, control and standards enforcements are discussed. Although thermal change is viewed as natural, the heat capacity of aquatic environments in the United States is often exceeded, and the increasing power production is an index of increasing thermal pollution. With higher water temperatures, toxic effects are greater, the water is less capable of assimilating other wastes, and the dissolved oxygen supply is less. One of the criteria of the Water Quality Act is water temperature, while recognizing natural climatic changes. In the state regulations, the varied social water interests are considered. Technological solutions to waste heat disposal are listed as follows: (1) methods to minimize the effect of the waste heat on the aquatic environment; (2) means to reduce waste heat produced in thermal generation plants; (3) uses for waste heat; (4) methods to cool the present amount of waste heat; (5) new non-polluting methods of power generation. (Sherman-Vanderbilt)
W69-09306

DIFFUSION OF COOLING WATER DISCHARGE FROM MARSHALL STEAM STATION INTO LAKE NORMAN,
Duke Power Co., Charlotte, N.C.
For primary bibliographic entry see Field 05B.
W69-09307

EUTROPHICATION OF THE ST. LAWRENCE GREAT LAKES,
Bureau of Commercial Fisheries, Ann Arbor, Mich.
Alfred M. Beeton.
Limnology and Oceanography, Vol 10, No 2, p 240-254, 1965. 4 fig, 3 tab, 52 ref.

Descriptors: *Great Lakes, *Eutrophication, *Hypolimnion, *Lake morphometry, *Lake morphology, *Dissolved oxygen, *Dissolved solids, *Nutrients, Oligotrophy, Phosphorus, Nitrogen, Biota, Sewage disposal, Domestic wastes.
Identifiers: *Mesotrophy, Transparency, Specific conduction.

Lakes Huron, Michigan, and Superior are classified as oligotrophic lakes on the basis of their biological, chemical, and physical characteristics. Lake Ontario, although rich in nutrients, is morphometrically oligotrophic or mesotrophic because of its large area of deep water. Lake Erie, the most productive of the lakes and the shallowest, is eutrophic. Several changes commonly associated with eutrophication in small lakes have been observed in the Great Lakes. These changes apparently reflect accelerated eutrophication in the Great Lakes due to man's activity. Chemical data compiled from a number of sources, dating as early as 1854, indicate a progressive increase in the concentrations of various major ions and total dissolved solids in all of the lakes except Lake Superior. The plankton has changed somewhat in Lake Michigan and the plankton, benthos, and fish populations of Lake Erie are greatly different today from those of the past. An extensive area of hypolimnetic water of Lake Erie has developed low dissolved oxygen concentrations in late summer within recent years. The information is detailed in tables and graphs. (Sherman-Vanderbilt)
W69-09315

THERMAL POLLUTION OF WATER COURSES,
Potomac Electric Power Co., Washington, D.C.
L. W. Cadwallader.
Proceedings of the Nineteenth Industrial Waste Conference, Purdue Univ, Lafayette, Indiana, p 9-11, May 5-7, 1964.

Descriptors: *Thermal pollution, *Environmental effects, *Water pollution effects, *Industrial wastes, *Water quality control, Freshwater, Nonconsumptive water use, Model studies, Biology.
Identifiers: *Biodynamic cycle.

A general account is given of the thermal pollution problem and research needs. Most highly recommended are field studies, viewing thermal pollution in the context of natural variations in temperatures. Laboratory information about temperature effects has been generalized but without substantiating data about natural conditions. There is little knowledge of the effects of heated discharges on the receiving water, especially on the competitive biodynamic cycle. World War II is seen as the beginning of concern about water resources (freshwater) because of new industrial expansion. The establishment of water standards is challenging because unqualified restriction of thermal discharges would severely limit the nation's electricity generating capacity. A hydraulic model study has been made to determine the intake-discharge arrangement for the best overall effect for Chalk Point on the Patuxent River. Final design details were based on temperature elevation in the river as predicted by the model. The Potomac Electric Power Company intends to monitor the site after operation begins, thus providing valuable field information. (Sherman-Vanderbilt)
W69-09317

THE EFFECT OF THE ADDITION OF HEAT FROM A POWERPLANT ON THE THERMAL STRUCTURE AND EVAPORATION OF LAKE COLORADO CITY, TEXAS, (STUDIES OF EVAPORATION),
Geological Survey, Washington, D.C.
Earl G. Harbeck, Jr., G. E. Koberg, and G. H. Hughes.
Geological Survey Professional Paper 272-B, U.S. Government Printing Office, Washington, 1959.

Descriptors: *Evaporation, *Thermal pollution, *Energy budget, Heat, Reservoir evaporation, Cooling water, Powerplants.
Identifiers: Powerplant, Thermal structure.

Lake Colorado City, a reservoir in north-central Texas, is used as a source of cooling water for a thermal-electric powerplant. Evaporation from the lake was determined by the energy-budget method for the period July, 1954 to October, 1955. Analyses indicated that if no heat had been added by the powerplant, the water-surface temperature would have been only 0.8 deg C lower than that observed. The temperature rise was almost directly proportional to the heat input. The increase in evaporation from Lake Colorado City, when expressed as a volume, was directly proportional to the amount of heat added and was practically independent of reservoir contents. The entire lake is being effectively utilized in disposing of heat. A comparison between average lake temperatures and plant intake water temperatures indicated that water was withdrawn from all levels of the lake above the pump intakes. (Ross-Vanderbilt)
W69-09320

OBSERVATIONS ON THE INFLUENCE OF THE NEW JOHNSONVILLE STEAM PLANT ON FISH AND PLANKTON POPULATIONS,
Tennessee Game and Fish Commission.
William Dryer, and Norman G. Benson.
Tenth Annual Conference Southeastern Association of Game and Fish Commissioners, Biological Abstract, Vol 10, p 85-91, 1957. 7 p, 3 tab, 1 fig, 1 ref.

Descriptors: *Thermal pollution, *Fish migration, *Fish food organisms, *Freshwater lake, Sport fish.
Identifiers: *Power plant effluent.

This study covered the period October 1955 to August 1956. Water for condenser cooling is drawn from Kentucky Lake at 633,000 gal/min. Spent water, raised in temperature ca. 10 deg F is released into a rectangular discharge harbor of 82 acres from which it is discharged into the main lake. Plankton collection in the harbor and main lake showed no significant increase in productivity associated with steam plant discharge. Tremendous numbers of shad were observed in the discharge harbor during winter months, probably attracted by warm water rather than plankton. The abundance of sauger and skipjack was related to the numbers of threadfin shad. All were rare in the harbor after March 15 when the temperature approached 60 deg. At that time, blue catfish, channel catfish and bluegill began to concentrate in the harbor. The catfish left the harbor in July when the temperature exceeded 80 deg. Fish population in the harbor differed greatly from the main lake where white bass, white crappie and large mouth bass predominate. Temp. of harbor - 51 to 55 deg, Lake - 41 to 45 deg. (Malaney-Vanderbilt)
W69-09321

TRANSLOCATION OF PHOSPHORUS IN A TROUT STREAM ECOSYSTEM,
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife; and Institute for Fisheries Research, Ann Arbor, Mich.
Robert C. Ball, and Frank F. Hooper.
Proc 1st Nat Symp on Radioecology, Colorado State Univ, Fort Collins, Sept 10-15, 1961. Radioecology, 1963, Reinhold Pub Corp, NY and Amer Inst of Biological Sciences, Wash, DC, Schultz, Vincent and Klement Jr, Alfred W (Eds), p 217-228. 4 fig, 7 tab, 16 ref.

Descriptors: *Translocation, *Phosphorus radioisotopes, *Trout, *Streams, *Ecosystems, Radioactivity, Biota, Cycles, Michigan, Invertebrates, Fish, Temperature, Tracers, Sampling, Periphyton, Aquatic plants, Background radiation, Geochemistry, Spring waters, Phosphorus, Organophosphorus compounds, Bacteria, Diatoms, Detritus, Cycling nutrients, Light intensity, Fertilization, Growth rates, Equilibrium, Chara, Algae, Ammocetes, Lampreys, Omnivores.
Identifiers: Michigan, Cheboygan County, Sturgeon River, Fluorescein, Macrophytes, Ground solids, Uptake, Consumer organisms, Simulium, Physa, Salmo trutta, Entosphenus lamottenii, Gammarus, Cordulegaster.

To explore movement of phosphorus in a cold-water stream and relationships between phosphorus and stream productivity, spikes of approximately 23 millicuries of phosphorus-32 (P-32) were added to the water during three summers. The loss pattern varied from year to year, with much uptake apparently attributed to periphyton and three aquatic macrophytes. P-32 rate of loss from plants to water decreased with time and concentration approached equilibrium level in 15 to 20 days after spike was released. Decrease change rates suggested that plants were removing re-cycled phosphorus from the stream water. Highest uptake by periphyton occurred in 1958 and 1960; lowest in 1959. This pattern was reversed by aquatic macrophytes. Concentration curves for consumer organisms reflected differences in metabolic turnover rates and food relationships. In Simulium, concentrations quickly rose to a high level, seemingly during passage of the spike. Other small filter feeders and periphyton scrapers also accumulated P-32 rapidly, then lost it quickly. Accumulating P-32 was slower for large omnivorous stream insects and smaller predacious forms. Differences in circulation through the ecosystem, as noted during the 3-year test period, may be due to distribution of P-32 between soluble and particulate phases. (See also Vol 2, No 19, Field 5C, W69-07863). (Jones-Wis)
W69-09334

THE PHOSPHORUS PROBLEM,
Department of the Interior, Washington, D.C.
Kenneth M. Mackenthun.
J Amer Water Works Ass, Vol 60, No 9, p 1047-1054, Sept 1968. 2 tab, 32 ref.

Descriptors: *Phosphorus, *Nutrients, *Eutrophication, *Tertiary treatment, Nitrogen, Aquatic plants, Bottom sediments, Dredging, Harvesting of algae, Fish harvest, Vitamins.
Identifiers: *Waste water (Municipal and industrial), *Phosphorus sources, *Nuisance plant growths, *Nutrient control, *Phosphorus concentrations, Micronutrients, Aquatic ecosystem, Midge larvae, Lake stratification, Surface area (Lakes), Phaedactylum, Waste water diversion, In-stream treatment, Bottom sealing, Lake dilution.

Reduction of wastewater phosphorus inflows to receiving waters is necessary to check accelerating cultural eutrophication. Minimizing phosphorus inflows to surface waters is recommended because it is the most easily reduced of all constituents in waste waters essential to aquatic plant growth. The author suggests that prevention of biological nuisances requires total phosphorus concentrations not exceeding 100 micrograms/liter at any point in flowing water; and 50 micrograms/liter where water enters a standing body (lake or reservoir). The most effective means of controlling phosphorus levels in lakes now are treatment of nutrient point sources, waste water diversions around lakes, and dilution within lakes where feasible. Once nutrients are combined within the ecosystem of the receiving water, their removal is tedious and expensive. Results of harvesting of aquatic crops, dredging, and other means to remove nutrients after they have reached receiving waters should be compared with inflowing nutrient quantities to evaluate effectiveness. The preservation of surface waters in a usable state will depend in the long run on maximum nutrient removal at the waste sources. (Ketelle-Wis)
W69-09340

THE PHOSPHORUS FRACTIONS AND THE TURNOVER TIME OF INORGANIC PHOSPHORUS IN DIFFERENT TYPES OF LAKES,
Toronto Univ. (Ontario). Dept. of Zoology.
For primary bibliographic entry see Field 02H.
W69-09342

THEORY OF THE CHEMOSTAT,
Microbiological Research Establishment, Salisb
(England).
E. O. Powell.
Laboratory Practice, Vol 14, No 10, p 1145-1
and 1161, Oct 1965. 6 fig, 21 ref.

Descriptors: *Growth rates, *Kinetics, *Micr
ganisms, Mathematical models, Mathematical
dies, Theoretical analysis.
Identifiers: *Chemostats, *Continuous cult
*Substrate-limited growth, Growth kine
Microbial nutrition.

The kinetics of continuous culture is discussed
special emphasis on its relevance to the opera
of chemostats. In spite of much simplification,
author feels that the basic equations relating
steady-state concentrations of nutrients and or
isms provide a useful description of the opera
of chemostats. The principal defects are conside
to be the assumed dependence of growth rate u
nutrient concentration, and the assumption that
yield is a constant. (Uttormark-Wis)
W69-09347

**RADIATION AS A TECHNIQUE IN S
BIOLOGY AND BIOCHEMISTRY,**
California Univ., Davis. Coll. of Agriculture.
For primary bibliographic entry see Field 02K.
W69-09350

**RESPONSE OF CHEMOAUTOTROPH
NITRIFIERS TO FOREST CUTTING,**
Yale Univ., New Haven, Conn.; and Dartmo
Coll., Hanover, N.H.
For primary bibliographic entry see Field 02K.
W69-09351

**ON THE CONSEQUENCES WHI
LOWERINGS OF THE WATER LEVEL F
AGRICULTURAL PURPOSES HAVE
MACROPHYTIC AND PLANKTONIC COM
NITIES OF SHALLOW LAKES WITHIN T
OLIGOTROPHIC AREA OF SOUTH SWED
(GERMAN),**
Lund Univ. (Sweden). Limnological Inst.
For primary bibliographic entry see Field 02H.
W69-09352

**A SYSTEMS APPROACH TO WATER POLL
TION,**
Cornell Univ., Ithaca, N.Y.
Daniel P. Loucks.
Water Wastes Eng, p 43-45, July 1969. 3 p, 2 fi
ref.

Descriptors: *Systems analysis, *Water pollut
control, *Mathematical models, *Optimizati
*Stream improvement, Political constraints, Pu
benefits, Decision making, Technical feasibility

A systems approach to the problem of water po
tion control and the implications of politics and
cial welfare in decision making were discussed
hypothetical water pollution control system
formulated and mathematical techniques were
plied for determining control methods for obta
ing optimum stream standards. The utility of the
formation obtained to decision makers
discussed. It was concluded that although a syste
approach could help individuals identify their c
ices in the order of preference, it was only i
political setting that the approach could have
relevance to public problems. (Thiuri-Cornell)
W69-09356

5D. Waste Treatment Processes

**NATURAL DRAUGHT COOLING TOWER
FERRYBRIDGE AND AFTER,**
Institution of Civil Engineers, London (England)
I. W. Hannah, and P. R. Owen.
Proceedings of the Conference at the Institution
Civil Engineers held June 12, 1967, London, W
liam Clowes and Sons, 1967. 113 p.

scriptors: *Cooling towers, *Structural design, thematical models, Wind, Wind pressure, Stress lysis.
ntifiers: *Wind loading, *Structural failure, ration of cooling-tower shells, Aerodynamic blems.

s book contains the proceedings of the con- nce held at the Institution of Civil Engineers on e 12, 1967, which centered on cooling tower gn and the Ferrybridge failure. The subjects ussed pertain to natural draught cooling ers. Reports on the resume of the report on the ures, structural philosophy, and the philosophy failure are included. The second part of the ceedings contains reports on mathematical ects of tower design, vibration of cooling-tower lls, and consequential problems at other stations Great Britain. The third part discusses wind ords and their application to structural design, e aerodynamic problems of grouped cooling ers, aerodynamic implications of the Fer- ridge research investigations, and problems of mating wind loading on structures with special rence to cooling towers. There is a discussion owing each of the three sections and a general ussion at the conclusion of the book. (Ross- nderbilt)
9-09041

RODYNAMIC IMPLICATIONS OF THE RRYBRIDGE RESEARCH INVESTIGA- ONS,
ntral Electricity Generating Board, Leatherhead gland). Central Electricity Research Labs.
. Lowe, and D. J. W. Richards.
Natural Draught Cooling Towers - Ferrybridge After, The Institution of Civil Engineers, p 79- 1967. 6 p, 5 fig, 3 tab, 7 ref.

scriptors: *Cooling tower, *Stress analysis, eteorological data, *Strain measurement, eynolds number, Wind pressure, Simulation lysis, Structural design.
ntifiers: *Ferrybridge, Wind loading, Wind tun- Transcritical region, Membrane stresses.

Paper critically examines the aerodynamic in- tigations which were undertaken in support of Ferrybri dge investigations, and their implica- s. It concludes that there is no reason to doubt general validity of the data but that there is an ent need to obt ain confirmatory full-scale mea- ements, to develop wind-tunnel techniques in ch atmospheric turbulence is simulated, and to vide a method of stress analysis which incor- ates the dynamic response of the tower. The im- tant influences of tower shape, site configura- , and fluctuating leads on wind-induced tower sses, were noted. Membrane stresses were wn to be sensitive to relatively small variations he mean pressure distribution over the tower face, and thus changes in tower shape or upings. (Sherman-Vanderbilt)
9-09042

EMICAL AND BIOCHEMICAL ASPECTS OF POSAL OF USED GROUNDWATER BY CHARGING (DUTCH),
nkwaterleiding der Gemeente Rotterdam therlands).
Rook.
Ingenieur, p G88-G92, Dec 20, 1968. 4 p, 1 fig, b.

scriptors: *Ground water recharge, *Artificial harge, *Applied water management, Water posal, Water control, Water pollution effects, mical properties, Physical properties, Thermal ution, Bacteria.

s paper discusses the various aspects in the hodology of recharging groundwater, after its into the subsoil. The principal conditions in respect are the following, which are treated in ail: freedom from solid suspended material, ence of gases (both possible agents in clogging undesirable chemical reactions), preclusion of bacterial activities, prevention of unacceptable rise in temperature. (Sherman-Vanderbilt)
W69-09054

THE PROBLEMS OF ESTIMATING WIND LOADING ON STRUCTURES WITH SPECIAL REFERENCE TO COOLING TOWERS,
National Physical Lab., Teddington (England). Aerodynamics Div.
For primary bibliographic entry see Field 08A.
W69-09055

A WATER-QUALITY HIERARCHY FOR ARID LANDS,
North Carolina Univ., Chapel Hill. School Public Health.
Daniel A. Okun.
IN W.G. McGinnies and B.J. Goldman, Eds., Arid Lands in Perspective, p 289-296, University of Arizona Press, Tucson, 1969. 8 p, 19 ref.

Descriptors: *Water reuse, *Potable water, Public utilities, Arid lands, Arizona, Water conservation, Taste, Reclamation (Waste water), Water utilization, Competing uses, Water supply, Water shortage, Public utilities, Water distribution (Applied), Water pollution, Viruses, Chemical wastes, Planning.
Identifiers: *Water-quality hierarchy.

As population increases and additional waters become polluted, direct reclamation and reuse of waste waters is rapidly becoming a necessity, especially in arid regions. Public acceptance of this varies in relation to experiences and attitudes. Treatment plants have been shown to be ineffective in elimination of many viruses that are present in wastewater. Also many chemical wastes of low concentration can be deliterious to health with long term use. It is proposed that municipalities in watershort areas, where less than 10 per cent of the water used is required to be of drinking-water quality, have a dual system. One system could consist of a high-quality potable supply for drinking and culinary purposes and the second system, with a lesser-quality supply, would serve for flushing, washing, lawn irrigation, and other nonpotable uses. Cost of dual supplies are discussed and it is concluded that they would be significantly reduced if the two systems were planned and installed simultaneously. This would be facilitated in new cities. The development of a hierarchy of water supplies based on water quality offers a reasonable approach to conserving this resource. (See W69-09210). (Sherbrooke-Ariz)
W69-09213

IMPORT ALTERNATIVES,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 03A.
W69-09220

SANITARY LANDFILL DESIGN,
University of Western Ontario, London; and Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 05E.
W69-09235

THE IMPACT OF THE DEEP TUNNEL PLAN ON THE WATER RESOURCES OF NORTHEAST ILLINOIS.
Harza Engineering Co., Chicago, Ill.; and Bauer Engineering, Inc., Chicago, Ill.
For primary bibliographic entry see Field 02F.
W69-09261

SENSORS FOR THE ANALYSIS AND CONTROL OF BIOLOGICAL PROCESSES,
Metropolitan Sanitary District of Greater Chicago, Ill. Research and Development Lab.
For primary bibliographic entry see Field 05A.
W69-09265

COOLING TOWERS: PROBLEMS....AND SOME TREATMENT PRACTICES,
Magnus Chemical Co, Inc.
Thomas F. Dalton.
Water Works and Wastes Engineering, Vol 2, p 53-56, Dec 1965. 1 tab, 13 ref.

Descriptors: *Cooling towers, *Cooling water, *Maintenance, *Algicides, *Corrosion control, *Dispersion, Recirculated water, Oxygenation.
Identifiers: *Alkaline cleaning, *Acidic cleaning, Scale preventors, pH adjustment, Bleed-off.

Because cooling towers are in continual use, they must be diligently maintained. Problems in the cooling system and chemical treatment selection factors according to water pollution control ratings are discussed. The following suggestions consider both overall effectiveness and cost of the chemical: Sodium chromate or sodium nitrate as corrosion inhabitors; chlorine as an algicide, polyphosphates or EDTA as scale preventors; sulfuric acid for pH adjustment; a precalibrated conductivity meter connected to a blowdown valve for bleed-off; sodium lignosulfonate as a dispersing agent. Both alkaline and acidic cleaning are recommended. Other uses for cooling water or cooling towers mentioned, are as a hot water recirculating system or as part of a modified activated sludge process. (Sherman-Vanderbilt)
W69-09316

HYPERBOLIC COOLING TOWERS WITH RESERVOIR STORAGE OF MAKEUP TO SERVE THE PROPOSED KEYSTONE GENERATING STATION,
Gilbert Associates, Inc., Reading, Pa., and Pennsylvania Electric Co., Johnstown.
Alexander F. Smith, III and Ralph E. Bovier.
Proceedings of the American Power Conference, Vol 25, p 406-415, 1963. 5 fig, 1 tab, 3 ref.

Descriptors: *Power plants, *Reservoir storage, *Cooling towers, *Waste-water treatment, *Thermal pollution, *Design criteria, Stream flow, Fuels, Transmission lines, Cost comparisons, Sites, Condensers.
Identifiers: *Pennsylvania, *Mine-mouth stations, *Keystone plant, Hyperbolic cooling towers.

This article describes the studies which led to the site selection of Keystone generating stations, indicating that large plants can be located on small streams, and proposes cooling arrangements which overcome specific difficulties at a location. The effect of discharges on stream flows during normal and critical years is shown. Coal resources and cost studies and a plant site survey were conducted. Hyperbolic cooling towers were chosen because they were economical for large unit installations with high load factors, they required less space than other units, and their stack heights (approximately 300 ft) minimized fog and air pollution problems. The tower's heat load can be increased by increasing either the water flow or the cooling range. The optimum cooling range was evaluated at 23 deg to 30 deg F. A makeup reservoir is most advantageous because of its mobility. A cost comparison with another river site concluded that the normal economic penalties of a cooling tower plant were not serious if the advantages of a closed-loop cooling tower arrangement were recognized. (Sherman-Vanderbilt)
W69-09318

MUSKEGON COUNTY PLAN FOR MANAGING WASTE WATER.
Muskegon County Board of Supervisors; and Bauer Engineering, Inc., Chicago, Ill.

Muskegon County Metropolitan Planning Commission, Mich, 1969. 130 p, 20 tab, 16 fig, 2 append.

Descriptors: *Land reclamation, *Water management, *Irrigation systems, *Nutrients, *Water quality, Water resources, Land development, Land management, Water quality control, Phosphates, Nitrates, Irrigation.
Identifiers: Muskegon County (Mich).

This report presents a metropolitan plan for enhancement which recognizes waste water as a resource out of place in the environment and seeks to utilize it productively in a program of comprehensive treatment including irrigation of agricultural and forest lands. This plan attempts to coordinate goals, problems, and opportunities of the metropolitan region with physical and engineering factors of water resource and waste management. Two basic precepts in the formulation of this plan are the concept of wastes as resources out of place and the conversion of open-ended management systems to closed systems. The first precept simply means that waste products or pollutants in one part of the water system might be resources in another place. The open system is typical of existing waste water systems where the wastes are ultimately discharged from the system. A closed system, however, retains the wastes by re-utilization. These precepts have been applied in the development of a waste water management system based on the utilization of treated waste water for irrigation. Muskegon County presently has large tracts of land unsuitable for agriculture due to lack of water and soil nutrients. The use of waste water would make this land productive through the addition of water and soil nutrients, especially nitrates and phosphates. In this particular case this technique served as potential aids in the solution of two basic problems of the area. First, the degraded water quality of water bodies in Muskegon County would be improved by the elimination of the discharge of waste water into the water bodies. Second, the scheme proposed would help to ameliorate a depressed economy in the area. The improvement in water quality would provide opportunities for a recreation industry which is presently minimal. The use of waste water nutrients for irrigation purposes would expand the agricultural sector which is presently underdeveloped. (Davis-Chicago)
W69-09331

DESIGN OF SANITARY SEWAGE COLLECTION SYSTEM BY ELECTRONIC COMPUTER,
Polytechnic Inst. of Brooklyn, N.Y. Dept. of Civil Engineering.
H. F. Soehngen, and P. R. DeCicco.
Soc Econ Planning Sci, Vol 1, No 3, 391-402, July 1968. 12 p, 11 fig.

Descriptors: *Design, *Sanitary engineering, *Sewage treatment, *Optimization, *Flow measurement, Mathematical models, Systems analysis, Sewers, Monitoring, Harbor.

The development of a systems approach to sanitary sewers design was discussed and a mathematical flow model developed. The project had two primary objectives, (a) to produce a computer oriented design which would produce results in less time with less cost and with a higher level of precision and (b) to utilize the memory and speed capability of the computer for optimal sewer design by using iterative techniques which allowed opportunity for redesign with continuous monitoring of cost implications. The integrated computer systems developed were applied to the Merrick Harbor Collection District in Nassau County. Definite economic advantages were observed. Total construction costs were minimized and engineering design costs were substantially reduced. (Thiuri-Cornell)
W69-09364

COMPUTER CONTROL ASPECTS OF AN ACTIVATED SLUDGE TREATMENT PLANT,
Goodyear Tire and Rubber Co., Akron, Ohio.
Ernest J. Neugroschl.
IFAC, Haifa Symp, Comput Contr Nat Resources, Public Util, Sept 1967. 36 p, 12 fig, 11 ref.

Descriptors: *Activated sludge, *Optimization, *Mathematical models, *Automatic control, *Water pollution control, Waste water treatment, Monitoring, Computers, Simulation, Biochemical oxygen demand.
Identifiers: Indianapolis Treatment Plant.

A mathematical steady state model was developed and the services of a computer employed for optimizing the process of pollution control by an automated activated sludge treatment plant. The goal of the study was to devise a plan for automatic control of the treatment plant by creating and maintaining optimum process conditions despite variations in influent flow and concentration; by (1) achieving optimal coordination of variables so as to remove the desired amount of waste, (2) reducing plant operating cost and (3) increasing protection against process failure through continued surveillance and monitoring. Average daily influent flow rates and biochemical concentrations (BOD) obtained from the Indianapolis Treatment Plant were used for a simulation of the control scheme. (Thiuri-Cornell)
W69-09369

SYSTEMS ANALYSIS OF THE ASSIMILATIVE CAPACITY OF STREAMS,
Public Health Service, Philadelphia, Pa. Delaware Estuary Comprehensive Study.
For primary bibliographic entry see Field 05G.
W69-09374

FOR BETTER POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W69-09375

STATE BOARD OF HEALTH SEWER SYSTEMS AND SEWAGE TREATMENT PLANTS.

17 SC Code Ann 248-250 (1962).

Descriptors: *South Carolina, *Sewage disposal, *Sewage treatment, *Regulation, Legislation, Sewage effluents, Sanitary engineering, Sewage lagoons, Oxidation lagoons, Sludge disposal, Sludge treatment, Water pollution, State governments, Conduits, Future planning, Engineering structures, Design, Soil structure, Filtration, Settling basins, Industrial wastes.
Identifiers: *State Board of Health.

No sewage shall be discharged into waters or on land in a manner adversely affecting public water supplies or causing a nuisance. No person or other entity shall construct or alter any sewage facility until complete plans have been approved by the State Board of Health. All plans submitted must contain specifications and an engineer's report. The engineer's report shall include: present and projected sewage flow needs based on population; character of industrial wastes; type of purification method proposed; character of soil through which sewers will be laid and portion which will be below ground water level sewage system components; and complete information on the body of water into which the final effluent is to be discharged. Statutory specifications for settling chambers, sludge digestion chambers, contact beds, trickling filters, and filter sand must be met. The discharge of sludge or screening into watercourses is prohibited. Sewage stabilization pond design, and construction must conform to statutory requirements concerning loading, shape, depth, inlets, outlets, dikes, pond bottoms, fencing, buffer zones and operation. Special dispensation may be given for temporary systems. (Harris-Fla)
W69-09405

POLLUTION CONTROL EFFORTS: 'TELL THE WORLD ABOUT IT'.
For primary bibliographic entry see Field 05G.
W69-09444

5E. Ultimate Disposal of Wastes

SUBSURFACE DISPOSAL: PRECAUTIONARY MEASURES,
Department of Energy, Mines and Resources (Canada).
D. D. McLean.
Ind Water Eng, Vol 6, No 8, p 20-22, Aug 1969. 3 p, 3 fig, 1 tab.

Descriptors: *Waste disposal, *Injection w
Aquifers, Aquicludes, Permeability, Poro
Water chemistry, Industrial wastes, Chem
wastes, Waste water disposal, Waste water t
ment.
Identifiers: Injection well operation and design.

Rules for the dependable construction, installa
and operation of waste injection wells are outli
One of the most important and least unders
considerations is the history and effect of the li
waste after it is injected into its receiving fo
tion. Ideally, the sedimentary formation shoul
uniform sandstone, limestone, dolomite, or f
tured shale of large areal extent with suffic
thickness, porosity, and permeability. Injec
horizons should have adequate overlying and
derlying aquicludes, low pressure, and be separ
from freshwater horizons. Formation fluids sh
be compatible with injected fluids and no
plugged wells should penetrate the injection fo
tion near the disposal well. The size and weig
the casing is important depending on the press
and depths encountered and the volume of flui
be injected. Larger injection strings reduce
head injection pressures, but oversize holes
more costly to drill. Injection rates can be
creased via chemical or mechanical stimula
Such methods not only effectively increase
porosity of the critical region of the well bore
also reduce the chance of plugging. To accura
evaluate the hydrologic properties of the disp
formation, injectivity tests should be made
disposal operation must include a prop
designed monitor program to detect failure of
ous components. (Knapp-USGS)
W69-09234

SANITARY LANDFILL DESIGN,
University of Western Ontario, London; and
linois State Geological Survey, Urbana.
R. N. Farvolden, and G. M. Hughes.
Ind Water Eng, Vol 6, No 8, p 26-28, Aug 196
p, 1 fig, 1 photo, 3 ref.

Descriptors: *Landfills, *Waste disposal, *Sani
engineering, Garbage dumps, Water pollution
trol, Environmental sanitation, Public he
Aquifers, Aquicludes, Groundwater movem
Soil water movement, Drainage.
Identifiers: Sanitary landfills.

Sanitary landfill design criteria to minimize p
tion of ground and surface waters are listed
discussed. The best way to minimize water
tamination is to keep the landfill unsatura
When the fill must be at or near the zone of sat
tion, the hydrologic conditions must be selecte
prevent fast migration of leachate, or to pro
convergent flow toward collection sites. Exam
of collection sites include slopes near stream
valleys; or where ditches, drains, and pump
wells may be constructed. An aquiclude under
landfill prevents downward percolation of leac
to underlying aquifers. It is becoming more
more common to plan a landfill site for ultimate
as a recreational facility. Piling the refuse into
is commonly practiced. While there are obvious
vantages to this procedure, there are some di
vantages. Again, spoil (for covering the refuse
ing daily operations) must be hauled to the du
ing face at the top of the hill, which is much m
expensive than having it piled adjacent to
dumping face, as in the trench-and-fill met
Also, the flow of groundwater in the vicinity o
site is controlled by the groundwater mound
develops under the hill of refuse. Springs of ob
tionable leachate should be anticipated in e
case where the waste is piled in hills. (Kn
USGS)
W69-09235

DISPOSAL OF BRINE EFFLUENTS FROM LAND DESALTING PLANTS: REVIEW BIBLIOGRAPHY,
Bureau of Reclamation, Washington, D.C.
G. W. DePuy.

of Saline Water, Research and Development
ss Report No 454. July 1969. 211 p. OSW
e0001-1306.

iptors: *Brine disposal, *Brines, *Saline
*Soil sealants, *Canal linings, Waste
al, Effluents, Ponds, Reservoir leakage,
ration, Evaporation pans, Costs, Desalina-
lants, Asphalt emulsions, Asphaltic concrete,
ete linings, Bituminous materials, Bibliogra-
Water pollution, Rubber, Seepage losses,
ws, Earth linings.
fiers: *Seepage control, *Salt recovery,
rimeters, Canal sealants, Asphalt mem-
, Plastic film, Evaporation reservoirs.

ureau of Reclamation has been authorized by
Fc. of Saline Water to conduct an 8-part pro-
on surface facilities for disposal of desalting
effluents. The program consists of: (1)
ring a state-of-the-art bibliography and a
, (2) test soil samples from a proposed brine
ration pond site, (3) laboratory tests on pond
materials and soil sealants, (4) develop a
oring system for seepage loss measurement,
velop techniques for increasing evaporation
(6) conduct field tests of pond linings and
p optimum application methods, (7) prepare
ual on surface facilities for disposal of desalt-
ant effluents, and (8) conduct an economic
of salt disposal. This review and bibliography
repared as Part I of the Bureau's program.
echnical literature was reviewed for informa-
n all parts of the Bureau's program. A survey
states and the Federal Water Pollution Con-
dministration on water pollution regulations
ning to surface facilities for disposal of desalt-
ant effluents is appended to the review. The
graphy contains 870 references. References
dexed and cross referenced according to 18
t areas. (DePuy-Bur of Reclam)
09353

**Y SYSTEMS - A METHOD OF INCREAS-
WATER EVAPORATION RATES TO
LITATE BRINE DISPOSAL FROM
LTING PLANTS,**
u of Reclamation, Washington, D.C.
Smoak.
of Saline Water Research and Development
ess Report No 480, Sept 1969. 19 p. OSW 14-
01-1306.

iptors: *Saline water, *Waste disposal/sprays,
disposal, *Evaporation, Cooling water,
y balance, Vapor pressure, Spraying, Tem-
re.
fiers: *Evaporation reservoirs, Spray
ration.

rt study was undertaken to determine the
l effectiveness of using spray systems to in-
the evaporation f water from desalting plant
disposal ponds. Spraying tests were made
00 ft. square test and control ponds. The
were calibrated over a 2-week period. Mea-
instruments installed at the ponds included:
ok gages, (2) staff gages, (3) a totalizing
meter, (4) a hygrothermograph, and (5)
ocouples for recording water surface tem-
re and average bulk temperature. Using 12
-cone spray nozzles, evaporation increases
g from 18% to 59%) were experienced with
rates of 32 gpm to 60 gpm, respectively.
k-Bur of Reclam)
9354

Water Treatment and Quality Alteration

**NATION OF THERMAL STRATIFICA-
IN RESERVOIRS AND THE RESULTING
ITS (with special emphasis on study of
Vohlford, California),**
ical Survey, Washington, D.C.; and Escon-
utual Water Co., Calif.
n E. Koberg, and Maurice E. Ford, Jr.
Geological Survey Water-Supply Paper 1809-M, 1965. 28 p, 14 fig, 1 tab, 13 ref.

Descriptors: *Thermal stratification, *Reservoirs, *Thermal pollution, Solar radiation, Wind, Mixing, Evaporation, Water quality.
Identifiers: Lake Wohlford (Calif.), Surface heating, Surface cooling, Floating aerator, Air-bubbling system, Plastic hose air-distribution system, Temperature prediction.

Thermal stratification in lakes and reservoirs increases the concentration of certain undesirable substances in the hypolimnion with an accompanying decrease in the dissolved-oxygen concentration. The temperature distribution within a lake is a function of diffusion and conduction, and such external agencies as solar radiation, wind, inflow, and outflow. The use of air bubbling to artificially induce mixing, successful in several investigations reported in the literature, is studied in detail in Lake Wohlford in collaboration with the Escondido Mutual Water Co. of Escondido, California. The results of the Lake Wohlford study indicate that the air-bubbling system is economically feasible to remove undesirable taste and odors from the water used for domestic purposes and to increase the dissolved-oxygen concentration in the hypolimnion of the lake. The results also indicate that the elimination of thermal stratification can reduce evaporation. The Lake Wohlford study and other tests cited have not presented enough data to define criteria for design of an air-bubbling system for a thermally stratified reservoir of a given capacity. Further studies are needed so criteria can be established. (Ross-Vanderbilt)
W69-09029

PRACTICAL CONTRIBUTIONS TO ASSURE NORMAL BIOLOGICAL CHARACTERISTICS OF DRINKING WATER (ROMANIAN),
Servan Constantinescu, and Ana Ionescu.
Hidrotehnica, Gosp Apelor, Meteorol, Vol 13, No 3, p 142-146, Mar 1968. 5 p, 7 fig, 1 tab, 6 ref.

Descriptors: *Water treatment, *Oligochoctes, *Iron bacteria, *Water supply, Sources, Biological properties, Water properties, Chlorine, Chlorination, Potable water.
Identifiers: *Romania, Bucharest water supply, Water chlorination.

The problem of eliminating animal and vegetal organisms from drinking water was mostly restricted to experimental work. This paper discusses a method of improving the biological properties of water. Many chemical, physical, and biological analyses were performed in the Bucharest area to determine the occurrence of Oligochaete worms in water. Results indicate the presence of Ferrobacteria such as Crenothrix, Leptothrix, Siderocapsa, etc, and Oligochaete worms such as Nais, Stylaria, and Aeolosoma. It was also found that Ferrobacteria which take their energy from iron components, constitute the substrata for the development of Oligachaete worms. Negative pipeline pressures resulting from interruptions in pumping, or excessive water use, were presumed to be associated with the problem. The worms were not found in water from catchments, treatment stations, intakes, reservoirs or pumping stations. Hydraulic and hydropneumatic washings were made to remove the crusts of iron compounds, particularly limonite, as a possible energy source for ferrobacteria. Laboratory experiments were conducted by using copper sulfate, aluminum sulfate, sodium chloride and chlorine. Later, slow and shock chlorination methods were used successfully to remove hazardous bacteria and worms from the drinking water. (Carstea-USGS)
W69-09288

A SYSTEMS APPROACH TO WATER POLLUTION,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 05C.
W69-09356

APPLICATION OF OPTIMAL CONTROL THEORY TO A CLASS OF RIVER AERATION PROBLEMS,
RUTGERS - The State Univ., New Brunswick, N.J.
B. Davidson.
Appl Syst Anal Sanit Eng, Proc, 4th Annu, AAPSE, Workshop, Clemson Univ, p 11-1 -- 11-6, June 1969. 6 p, 7 fig.

Descriptors: *Aeration, *Optimization, *Control systems, *Design, *Pollutants, Water quality control, Analog computers, Digital computers, Stream improvement, Numerical analysis.
Identifiers: Pontryagin's Extremum Principle, Sirazetdinov-Tarassov-Perlis algorithm.

Optimal Control Theory was explained for lumped and distributed parameter systems using the artificial instream aeration problem as an illustrative example. The presentation commenced with a discussion of modern, state-space control theory for systems of ordinary differential equations followed by a statement of Pontryagin's Extremum Principle. The algorithm was then applied to the optimal design of steady-state, artificial aeration for polluted rivers. Distributed parameter optimization and the Sirazetdinov-Tarassov-Perlis algorithm was then presented and its application to the unsteady-state or optimal start-up aeration problem was discussed. Examples of numerical problems were given. Both analog and digital computers were used in obtaining optimal results. (Thiuri-Cornell)
W69-09359

DITTMAN V NAGEL (BREACH OF WARRANTY OF WELL WATER).

168 NW 2d 190-196 (Wis 1969).

Descriptors: *Wisconsin, *Potable water, *Water pollution, *Wells, Consumptive use, Water quality, Bacteria, Water pollution sources, Legal aspects, Judicial decisions, Remedies, Damages, Relative rights.
Identifiers: *Warranty.

Plaintiff brought action to recover damages for an alleged breach of an express warranty that a well on property purchased from defendants produced an adequate supply of water fit for human consumption. At trial, plaintiffs testified that when they took occupancy on May 30, 1965, the well was producing polluted water. Defendants testified that the well water was safe up to and including May 28, 1965, the day they moved from the premises. The trial court awarded damages and defendants appealed. The appellate court reversed on the grounds that the evidence didn't support the verdict. The court agreed that the warranty was binding as to both the quantity and quality of the water. However, the court held that a warranty to be breached must be breached at the time of sale. The date of sale most favorable to the plaintiffs was May 7, 1965. No evidence was presented to prove the water was polluted at any time before May 30, 1965. The burden of proof is on the party relying on breach of warranty to show the breach of that warranty. Plaintiffs did not meet that burden. (Gabrielson-Fla)
W69-09410

5G. Water Quality Control

THERMAL POLLUTION OF WATER SYSTEMS,
Rutgers - The State Univ., New Brunswick, N.J.
For primary bibliographic entry see Field 05B.
W69-09039

DEBATE ON THERMAL ISSUE CONTINUES.

Environmental Science and Technology, Vol 3, No 5, p 425-427, May 1969. 3 p.

Descriptors: *Thermal pollution, *Water pollution effects, *Waste water treatment, *Legal aspects, Power plants, Cooling towers, Lagoons, Public utilities, Construction costs.

Identifiers: *Water Quality Improvement Act, *Federal Power Commission, Columbia River Study, Connecticut River Study.

Thermal pollution control problems are discussed with reference to pending legislation. Water treatment projects by public utility industries are deterred because of their cost which is estimated at $1.8 billion dollars in 5 years. These companies are funding studies of water pollution effects, however. Larger and more concentrated heat loads are predicted with substantiating data. Columbia and, lticut River Studies are preparing mathematical models of the biological effects of heat loading. Licensing of the plants may soon require compliance with water quality standards to be decided by state agencies. Various cooling facilities are described with examples of existing construction. Cost is dependent on the choice of the system and cannot be generalized for: cooling lagoons, cooling towers, mechanical draft (forced or induced blower systems), natural draft. (Sherman-Vanderbilt)
W69-09047

COMMONWEALTH V NEW YORK AND PENNSYLVANIA CO. (EQUITABLE RELIEF FROM STREAM POLLUTION).

367 Pa 40, 79 A 2d 439-448 (1951).

Descriptors: *Pennsylvania, *Pollution abatement, *Industrial wastes, *Water pollution, Judicial decisions, Legal aspects, Remedies, Water law, Rivers, Public health, Administrative decisions, Water pollution control, Regulation, Abatement, Water quality control, State governments.
Identifiers: *Public nuisance.

Plaintiff, the Commonwealth of Pennsylvania, brought an action to abate a public nuisance created by the discharge of industrial wastes into the Clarion River. The lower court denied relief upon the grounds that the Sanitary Water Board under the Pure Streams Act of 1937 had exclusive control to determine public nuisances resulting from stream pollution. The plaintiff appealed. It was clear that defendant had polluted the Clarion River to the detriment of public health. Their actions were being reviewed by the Sanitary Water Board when plaintiff sought equitable relief. On appeal plaintiff gained relief. The court held that it was not the purpose of the 1937 act to supplant former or future actions in equity to abate public nuisances in streams. The strong public policy of the state was to abate public nuisances and the 1937 act only supported the equitable or common law remedies. When the public waters were corrupted by pollution a determination by the Sanitary Water Board that such was a public nuisance was not a pre-requisite to obtaining equitable relief. (Holt-Fl a)
W69-09060

SIZING UP ANTI-POLLUTION LEGISLATION,
Laurence W. Ross.
Chemical Engineering, Vol 74, No 15, p 191-196, July 17, 1967. 6 p, 18 ref, 2 tab.

Descriptors: *Water Quality Act, *Water quality control, *Water pollution, *Standards, Air pollution, Analytical techniques, Pollutants, Water pollution control, Water pollution effects, Pollution abatement, Color, Acidity, Turbidity, Bacteria, Industrial wastes, Water supply, Water types, Domest ic water, Potable water, Recreation facilities, Wildlife, Water util ization, Federal government, Federal-state water rights conflicts, Legislation, Chemical wastes, Legal aspects, Industries.

This country is faced with pressing problems from both air and water pollution. The Wat er Quality Act of 1965 is a good focal point for discussion regarding water pollution. Under that act the states are required to establish standards acceptable to the Department of the Interior or the Department will set the standards. Federal authority is to be invoked only if the states do not act. The state standards must include specific criteria and a plan for enforcement. The plan will be evaluated with respect to various types of water supplies and requirements. The criteria established by the states must be general enough to allow the states to respond to technological advances. The criteria should cover bact eria, dissolved oxygen, pH, and temperature, and be dependent on the anticipated water use. The 'Water Quality Criteria' is an excellent basis for evaluation of chemical plant discharges. The specialty industries such as food and textile are the most vexing to the authorities who must establish the criteria. Color and turbidity present the biggest problems of water pollution. The timetables for enforcement will allow older industries that cannot reform ample time to terminate. (Shevin-Fla)
W69-09061

AIR POLLUTION, WATER POLLUTION, INDUSTRIAL COOPERATION AND THE ANTITRUST LAWS,
Philip K. Verleger, and Jennie M. Crowley.
Land and Water L Rev, Vol 4, No 2, p 475-486, 1969. 12 p, 34 ref.

Descriptors: *Pollution abatement, *Water pollution, *Industrial wastes, *Federal government, Water pollution treatment, Legislation, Industrial plants, Water utilization, Control, Operations, Standards, Social aspects, State governments, Legal aspects, Judicial decision, Regulation, Competition.

In order to effectively abate industrial pollution, cooperation is needed among the industries both in the fields of research and operation. This cooperation may possibly bring these industries into direct conflict with Federal Antitrust laws. These regulations may be used to attack industry for conspiring in violation of the Sherman and Clayton Acts even if there is an effort on the part of industry to collectively agree to engage in certain practices which would aid in reducing pollution. In order for the problem of pollution to be solved, cooperation among competitors in industry must take place, and there must be added cooperation f rom state and federal government. Industries are regulated by government and there is a basic constitutional right among the regulated to collectively discuss the demands of the regulator. State and federal legislation dictate rules for the industry as regards pollution; however, the industrys' right to discuss collectively their ideas of this problem must be protected and not be allowed to fall prey to antitrust legislation. (Shevin-Fla)
W69-09062

WHAT PRICE A QUALITY ENVIRONMENT,
Jack W. Carlson.
Journal of Soil and Water Conservation, Vol 24, No 3, p 84-88, May-June 1969. 5 p, 2 ref.

Descriptors: *Cost-benefit analysis, *Pollution abatement, *Future planning (Projected), *Project benefits, Public benefits, Pollutants, Air pollution, Water pollution control, Costs, Long-term planning, Environment, Cost analysis, Cost trends, Cost-benefit ratio, Management.

Attempting to abate pollution implies that environmental quality goals have been assessed. Goals must vary with cost, and cost of quality control must not exceed the damage inflicted. Costs and benefits, then, must be measured. Benefits are often difficult to measure because we lack adequate environmental quality or social indicators. There are problems with determining the nature of human well-being, measuring aesthetic and health benefits, and projecting benefits into the future for future generations. Costs of improvements are easier to measure than benefits, but analysts should be wary of using simple calculation methods. All of the new data that are now available must be utilized in order to prevent inflated cost estimates. A recent federal study found that costs were much lower than expected. Costs to industry are only a fraction of one percent of the added. Consumers could finance abatement similar fraction of annual income. Manageme environmental quality is extremely important this can best be done if management institu can encompass the location where they orig and cause damage. (Douberley-Fla)
W69-09063

VIAN V SHEFFIELD BLDG. AND DEV. (SUIT TO ENJOIN DISCHARGE OF SEWA
88 NE 2d 410-415 (Ct App Ohio 1948).

Descriptors: *Ohio, *Sewage, *Surface drai *Prescriptive rights, Pumping plants, Sewag fluents, Sewage disposal, Surface waters, Drai Sewers, Ditches, Lake Erie, Beaches, Disc (Water), Legal aspects, Judicial decisions, Re rights, Industrial wastes, Alteration of flow.

Plaintiff herein was seeking to enjoin defe building and development company from discharging surface waters upon plaintiff's pr ty; and (2) casting sewage and/or disposal pla fluent thereupon through the use of ditches sewers. The court found that plaintiff had fail sustain the burden of proof of showing that d dant had in fact diverted and cast surface w upon plaintiff's property. The court further that in accordance with Ohio law one may no tain by prescription or otherwise than by purc a right to cast sewage upon the lands of an without his consent. Plaintiff met his burde proof in showing that defendant had caused se to flow upon plaintiff's property, and the re for an injunction was granted. (Logan-Fla)
W69-09064

ALL HE WANTS TO DO IS SAVE THE WO
Gilbert Rogin.
Sports Illustrated, Vol 30, No 5, p 24-29, F 1965. 6 p.

Descriptors: *Conservation, *Pollution, *Na resources, *Public benefits, Air pollution, S aspects, Wildlife conservation, National parks tional forests, Preservation, Scenery, DDT, In cides, Environmental sanitation, Air pollutio fects, Injunction, Damages, Ecology, Mosqu Pollution abatement, Drainage, Lakes, P rights, Michigan, New York, Remedies, aspects.
Identifiers: *Environmental Defense Fund, glades.

The Environmental Defense Fund and its atto Victor Yannacone, are probably this cou most 'militant' conservationists. They do not for the answers for preserving our natural reso by writing letters to the editors or by lobbyi legislatures, but rather, have taken their batt the courts. EDF's court actions have not s damages, but have been brought on behalf class seeking injunctive relief and a declarati the public's rights. Its biggest battle to dat been against the use of DDT. EDF has y receive a favorable court holding but a decisi a New York judge stated that while legislatio required he determined that DDT is harmfu Michigan, EDF was successful in getting sever ties to agree to stop using DDT. EDF's bigges lies ahead in a pending suit against a paper pla Montana which the organization declares is p ing the air of the Missoula Valley. The organiz is only handcuffed by lack of funds. EDF's nex tle, if possible, will be the problem of alli poaching. (Shevin-Fla)
W69-09078

HEALTH AND SAFETY (ADMINISTRA AUTHORITY FORMATION).

Del Code Ann tit 16, sec 1401-1421 (Supp 19

Descriptors: *Delaware, *Administration, governments, *Sewage disposal, Legisl

wage, Sewage system, Water system, Waste eatment, Administrative agencies, Cities, Water, aste, Municipalities, Financing.

his statute creates and organizes an authority to ercise public and essential governmental functons necessary to provide for public health and elfare. The powers granted by this chapter are not be exercised in a duplicative or competitive anner with regards to existing utilities, public or ivate, serving substantially the same purposes. evenue bonds may be issued by the created thority for the purpose of paying the whole or y part of the cost of any project. The fees, rates, d charges of each authority shall be fixed so as to y the operating, maintenance, and repair costs of e pertinent sewage system. Also included within e purview of this chapter are provisions concern- g the conditions under which property owners ust connect with the sewerage system. (Moulder- a)
69-09089

URE WATERS BOARD.
Ann Stat ch 19, secs 1001-1008.13 (Smith-Hurd pp 1969).

escriptors: *Water resources development, *Illnois, *Administrative agencies, *Water supply, oordination, Planning, Legislation, Administrave costs, Leadership, Adoption of practices, Decion making, Procurement, Water resources anning, Project planning, Programs, Evaluation, nancing, State governments, Publications, griculture, Conservation, Forecasting, Govers, Future planning (Projected), Investigations.

he Pure Wat ers Board is created to provide sound anning and maximum coordination of the efforts state agencies in water resources development d planning. The Board shall consist of the rectors of the various state agencies involved in ater resources. Members of the Board are to ceive no pay. The chief of the Division of Water d Natural Resources shall be the technical secrery to handle the Board's business when it is not eeting. The Board may call on any state educaonal institutions, board or department for sistance. The Board may request these bodies to rry on studies for the Board's biennial assessment the adequacy of state water supplies. The Board ay also employ consultants. The Governor and eneral Assembly shall receive the Board's bienni- assessment. Also the Governor shall receive the oard's recommendations on programs to insure lequate water supply. Publications informing the ublic of the existing conditions of the state water sources are to be prepared by the Board. It shall amine all water resources projects, existing and oposed, and send recommendations about them the G overnor. In matters of policy concerning ojects involving state departments and the nited States the Board will represent the state. he Board shall appoint regional water resources mmissions to plan for regional water resources. Jadd-Fla)
69-09123

IVER CONSERVANCY DISTRICTS.
Ann Stat ch 42, secs 383, 392a, 394, 401, 403, 4, 409 (Smith-Hurd 1956), as amended, (Supp 69).

escriptors: *Illinois, *Administrative agencies, Water conservation, *Pollution abatement, gislation, Water law, Legal aspects, Jurisdiction, ater pollution control, Highways, Taxation, Prots, Judicial decisions, Political aspects, Water sources, Water utilization, Ditches, Sewers, Assments, Construction, Financing, Channels, ds under water.
entifiers: Conservancy districts, Special assessents.

henever unified control of a lake or river system comes necessary, a conservancy district may be rmed after approval of a petition presented by a specified number of voters to the circuit court and upon approval in a general election of qualified voters within the proposed district. The board of trustees of any conservancy district has certain enumerated powers and duties so that it may carry out its assigned corporate functions. The district may const ruct sewers, channels, and ditches along or under highways and may establish necessary pipes and conduits on the beds under the surface of state waters. The board is charged with prevention of pollution within its jurisdiction and may appoint a sufficient police force to enforce laws relating to this duty. Special assessment and general taxation are the two methods by which district projects are financed. The board is specifically charged with seeing that parties responsible for pollution cease activities which are the cause thereof. (See also W69-09126 thru W69-09128). (Johnson-Fla)
W69-09125

RIVER CONSERVANCY DISTRICTS.

Ill Ann Stat ch 42, secs 383, 392a (Smith-Hurd 1956), as amended, (Supp 1969).

Descriptors: *Illinois, *Administrative agencies, *Water conservation, *Water utilization, Flood control, Pollution abatement, Legislation, Legal aspects, Water law, Jurisdiction, Political aspects, Water pollution, Water pollution control, Sewage, Water supply, Drains, Ditches, Sewers, Bridges, Eminent domain, Electric power production, Construction, Bridge construction, Condemnation, Maintenance.
Identifiers: Conservancy districts.

Whenever unified control of a lake or river system or a portion thereof is deemed conducive to the prevention of stream pollution, control or prevention of floods, disposal of sewage or provision of domestic, industrial or public water supplies one per cent of the legal voters may initiate a petition for the formation of a river conservancy district. Such petition must be brought before the circuit court which passes upon its necessity after a public hearing. If approved by the court, a general election of the voters in the proposed district is held in which a majority of those voting must approve the formation of the district. The powers and duties of the board of trustees include the cleaning out, widening, or deepening of any drain, sewer, river, pond or water course, constructing and maintaining ditches, sewers and canals, constructing and enlarging bridges in the district, and holding, purchasing or condemning real or personal property, but not furnishing water power or electricity for private use or otherwise. (See W69-09125). (Johnson-Fla)
W69-09126

RIVER CONSERVANCY DISTRICTS.

Ill Ann Stat ch 42, secs 394, 401, 403 (Smith-Hurd 1956), as amended, (Supp 1969).

Descriptors: *Illinois, *Water utilization, *Water conservation, *Water pollution control, Administrative agencies, Legislation, Legal aspects, Water law, Recreation facilities, Wildlife habitats, Water supply, Regulation, Water sources, Dams, Reservoirs, Water purification, Pumping, Pipelines, Costs, Sewers, Ditches, Drains, Highways, Construction.
Identifiers: Public waters.

The board of trustees may acquire land for use in construction of parks, recreational areas, wildlife areas and water supply. It may adopt and enforce regulations relating to protection of water sources as well as build dams and reservoirs for water storage, water purification works, pumping stations and pipelines for production and delivery of pure water to consumers. The board must sell water at rates that will at l east defray all fixed, maintenance and operating expenses and profits from such sale must be used for extention and improvement of water facilities. Each district may construct, maintain, and extend its sewers, pipelines, ditches and drains along or under highways, streets or alleys and may operate conduits and pipes, wholly or partially submerged, under the public waters of the state provided that permission for same is granted by the governor and that normal use of the waterbody is not impeded thereby. The board has the duty to prevent pollution of the water supply and may appoint and support a sufficient police force for same with jurisdiction not only within the district but also to as far as fifteen miles from the intake of such water supply. (See W69-09125). (Johnson-Fla)
W69-09127

RIVER CONSERVANCY DISTRICTS.

Ill Ann Stat ch 42, secs 404, 409 (Smith-Hurd 1956), as amended, (Supp 1969).

Descriptors: *Illinois, *Pollution abatement, *Water conservation, *Water utilization, Drains, Sewers, Laterals, Legislation, Water law, Water policy, Construction, Taxes, Sewage disposal, Administrative agencies, Jurisdiction, Water pollution control, Assessments, Financing.
Identifiers: Special assessments, Shore improvements, Sanitary dist-icts.

Construction of drains, sewers or laterals, septic tanks, water pipes, local shore improvements and dams and improvement of channels, beds and banks may be initiated by the board of trustees. Such projects may be financed by special assessment or general taxation. The board may contract with any sanitary district for sewage disposal within the conservancy district. Special assessments must be made in relation to the benefit gained by such projects; however, they may not be applied on property wholly outside the district. It is a primary duty of the board to see that pollution within the district is prevented and such board must cause all persons, parties, firms and corporations to cease pollution of all waters within the state, provided that in so doing the board does not supersede the authority of the Sanitary Water Board of the State of Illinois or its successor. (See W69-09125). (Johnson-Fla)
W69-09128

CHEMICAL CONTAMINANTS FOUND IN SURFACE AND SUBSURFACE WATER AS RELATED TO SOIL AND CLIMATIC CONDITIONS.
Maine Univ., Orono.

Project Completion Report, Maine Water Resources Center, August, 1969. 28 p, 17 tab. OWRR Proj A-006-ME.

Descriptors: *Insecticides, *Water quality, *DDT, *Endrin, Runoff, Sediment.
Identifiers: *Endosulfan.

Runoff was collected from plots maintained under various cropping systems. Samples were separated as to sediment and water and analyzed for pesticides and various elements. Pesticides were analyzed by electron capture gas chromatography whereas inorganic chemical elements were analyzed by atomic absorption and colorimetry. The concentration and amounts of endosulfan, endrin and DDT were lower in runoff from a rotation system of potatoes, sugarbeets and peas than from continuous potatoes. The amounts of insecticides in runoff were small compared to the amount applied. Less than one percent of the amounts applied were received in runoff. The concentration of the insecticides were considerably higher in the soil or sediment fraction of the runoff. A study on the retention of insecticides on two soils suspended in water showed that the insecticides tend to concentrate in the 0.08-0.5 mu clay fraction. The retention of the insecticides studied differed for the two soils studied. The intact Marshall soil retained more of each insecticide than the Caribou soil probably because of the higher organic matter content. In the clay fraction the retention was higher in the Caribou soil even though there is less organic

matter than in the Marshall. (See also W69-09229).
W69-09228

CHLORINATED INSECTICIDES IN RUNOFF WATER AS AFFECTED BY CROP ROTATION,
Maine Univ., Orono.
E. Epstein, and W. J. Grant.
Soil Science Society of America Proceedings, Vol 32, No 3, p 423-426, May-June 1968. 4 p, 6 tab, 20 ref.

Descriptors: *Pesticides, Erosion, *DDT, *Endrin, Gas chromatography.
Identifiers: *Endosultan.

The concentration and amounts of three chlorinated insecticides were lower in runoff from a rotation system of potato (Solanum tuberosum L.), oats (Avena sativa L.), and sod, than under continuous potato cropping. Runoff samples from natural runoff plots were collected following each storm, and the amounts of DDT, endrin, and endosulfan were analyzed with a gas chromatograph. The amounts of pesticides in runoff were small compared to the amount applied. The concentrations of the insecticides in the runoff (soil-water suspension) were generally greater than those found in the settled soil (sludge). (See also W69-09228).
W69-09229

ELECTRIC UTILITIES INCLUDE BUILT-IN SAFEGUARDS FOR ENVIRONMENTAL PROTECTION.

Environmental Science and Technology, Vol 3, No 6, p 523-525, June, 1969.

Descriptors: *Thermal pollution, *Air pollution, *Water pollution, *Waste treatment processes, Electric power plants, Engineering structures, Cost comparisons, Cooling towers, Reservoirs.
Identifiers: *Gilbert Associates Inc, *Keystone Power Station, *Homer City Power Station, *Conemaugh Power Station.

The design, cost, and efficiency of pollution control faci lities in the building of electric power plants is discussed in three sections: Water, ai r, thermal aspects. The three stations concerned are mine-mouth plants in Pennsylvania, Keystone (two 900 mw units), Homer City (two 640 units), Conemaugh (two 900 mw units). Water demand is reduced in the new plants by cooling towers, recirculating systems and storage reservoirs used to augment low flow streams in the summer and also as a neutralizer. New protection devices (oil skimmers, diversionary dams and ditches, and manhole appurtenances) were used to keep oil spillage from contaminating the streams. Electrical precipitators (95% efficiency) were used to control fly ash and high stacks were designed to avoid ground level concentration of SO2. Air quality levels are being tested at all three plants. Large electric stations can be located on small streams without pollution hazards if designed with water storage and hyperbolic natural draft types. Large cooling towers are the most economical of all systems. (Sherman-Vanderbilt)
W69-09302

NATURAL DISPLACEMENT OF POLLUTION FROM THE GREAT LAKES,
Oak Ridge National Lab. Tenn.
Robert H. Rainey.
Science, Vol 155, p 1242-1243, Mar 10, 1967. 1 fig, 1 tab, 3 ref.

Descriptors: *Great Lakes, *Model st udies, *Flow rates, *Eutrophication, Pollutants, Water pollution.
Identifiers: *Natural displacement.

A simplified mathematical model of a lake system (assumptions of equal flow rate to and from the lake, constant concentration of pollutants in streams entering the lake constant rate of pollution and distribution of pollutants in lake volume) indicates that if the pollution of the Great Lakes were discontinued, the natural flow through the lower Great Lakes would be sufficient to remove about 90 percent of the waste in about 20 years. On the other hand, hundreds of years would be required to displace the pollution from Lake Michigan and Lake Superior. Although the mathematical relationship ignores many factors influencing the contamination of lakes, it is a close representation of the lower Great Lakes because of their relative shallowness. Quantitative data is diagrammed. (Sherman-Vanderbilt)
W69-09311

A NEW CRITICAL PHASE OF THE LAKE WASHINGTON POLLUTION PROBLEM,
Washington Univ., Seattle. Dept. of Sanitary Engineering.
R. O. Sylvester.
Trend Engineering, Washington Univ, Seattle, Vol 8, p 8-10, Apr 1956. 2 fig, 7 ref.

Descriptors: *Water pollution sources, *Water pollution control, *Pollution abatement, Water supply, Sewage treatment, Washington, Eutrophication.
Identifiers: *Lake Washington, Sewer outfalls, Combined sewer systems, Lake fertilization, Aquatic plant nuisance, Effluent diversion, Nutrient reduction, Metropolitan Sewage Planning Agency, Washington, King County, Snohomish County, Seattle, Mercer Island, Bellevue Sewer District, Duwamish River.

Lake Washington, with approximately 38 square miles of surface water, is situated in the Seattle metropolitan area and supplies drinking water to 15,000 people. In addition to natural runoff from the urban area, outfall sewers from the metropolitan area discharged into the lake until 1941. Seattle's sewage is now diverted and treated outside the area, eventually reaching Puget Sound. However, combined sanitary and storm sewers frequently overload and mixtures of sanitary and storm sewage flow into the lake. Since 1941, ten additional treatment plants have been constructed which discharge treated effluent. Principal sources of lake pollution now are: (1) inflowing waters at north end, (2) overflows from Seattle's combined system, (3) septic tank leachates, and (4) overloads of treatment plants along shoreline. These sources still supply enough nutrients to cause a serious nuisance at some seasons. The solution may involve one, or a combination, of the following: (a) formation of a metropolitan sewerage planning agency, (b) complete elimination of sewage discharge by pumping all effluents to Puget Sound, (c) research on interrelationships between water temperature, algal growth, and nutrients to determine conditions under which increased nutrients could be tolerated without causing an extreme nuisance environment. (Ketelle-Wis)
W69-09339

WATER-QUALITY MANAGEMENT AND LAKE EUTROPHICATION: THE LAKE WASHINGTON CASE,
Washington Univ., Seattle. Dept. of Zoology.
W. Thomas Edmondson.
Water Resources Management and Public Policy, Washington Univ Press, Seattle, p 139-178, 1968. 2 fig, 1 tab, 104 ref.

Descriptors: *Lakes, *Eutrophication, *Sewage effluents, *Nutrients, *Nitrogen, Phosphorus, Sulfates, Vitamins, Algae, Growth rates, Copper sulfate, Bottom sediments, Lake Michigan, Washington, Dissolved oxygen.
Identifiers: *Effluent diversion, *Water quality management, *Lake Washington, *Sewage fertilization effects, *Biological productivity, Aquatic nuisances, Transparency, Agricultural runoff, Nutrient budgets, Comparative studies, Nutrient removal, Lake recovery, Wisconsin, Lake Monona, Lake Mendota, Lake Waubesa, Lake Kegonsa, Lake Zurich, Oscillatoria rubescens, Cladophora, Dinobryon divergens, Switzerland, Lake Lucerne, Lake Constance, Washington, Puget Sound, Bare Lake (Alaska), Lake Lyngby So (Denmark), Lake Tahoe (Calif), Lake Maggiore (Italy), Species dominance.

Lake Washington's case parallels other lakes worldwide where cultural eutrophication has led to increased biological productivity, limiting water uses. First definite indication of enrichment appeared in 1955 with abundance of Oscillatoria rubescens, followed by reductions in transparency and dissolved oxygen levels in water. Present solution to the problem has been almost total diversion of effluents from the lake, completed in 1967 at a cost of $85 million (including new treatment facilities). Evidence of the role of sewage in fertilization and lake deterioration comes from many sources: direct observation; urbanization followed by symptoms of increased lake productivity; nutrient budget studies, indicating relative nutrient percentages from different sources; comparison of similar lakes in different environments; changes resulting from sewage effluent diversions around lakes; bioassay techniques of lake water samples; and physiological studies of algae grown in nutrient solutions. The relative importance of various nutrients and maximum allowable concentrations in lakes are dependent on several interrelated factors including diverse effects of different combinations of nutrients, and variety in reactions by species to nutrients. Improved methods of nutrient removal from sewage will undoubtedly develop, but at present, effluent diversion is the only sure method of controlling enrichment of lakes. (Ketelle-Wis)
W69-09349

DAILY STREAMFLOW SIMULATION,
Sacramento State Coll., Calif.
For primary bibliographic entry see Field 06A.
W69-09355

THE USE OF DYNAMIC PROGRAMMING IN REGIONAL WATER QUALITY PLANNING,
Clemson Univ., S.C.
B. C. Dysart, III.
Appl Syst Anal Sanit Eng, 4th Annu, AAPSE Workshop, Clemson Univ, p 10-1 -- 10-23, June 1969. 23 p, 3 tab, 14 fig.

Descriptors: *Dynamic programming, *River basins, *Optimization, *Pollution abatement, *Water quality control, Streamflow, Biochemical oxygen control, Dissolved oxygen, Reaeration, Treatment facilities.

Dynamic programming techniques were used to demonstrate the process of modelling a river basin for quality control. The objective of the research was to determine the least total cost treatment level or abatement policy required at each outfall to meet specified water quality standards. Only a single type of waste, biochemical oxygen demand, was considered. Consideration was given to the effects of changes in the system parameters such as streamflow, reaeration and deoxygenation rate coefficients and dissolved oxygen standards, on the basin cost and abatement policy. The procedure was found to be equally applicable for any other waste type for which transport or dissipation models existed. (Thiuri-Cornell)
W69-09358

SOME STOCHASTIC MODELS FOR WATER QUALITY CONTROL,
Cornell Univ., Ithaca, N.Y.
Daniel P. Loucks.
Appl Syst Sanit Eng, Proc, 4th Annu, AAPSE Workshop, Clemson Univ, p 2-1 -- 2-11, June 1969. 6 p, 9 fig.

Descriptors: *Stochastic processes, *Water quality control, *Waste water treatment, *Markov

rocesses, *Optimization, Streamflow, Flow augentation, River basins, Design criteria.

n application of stochastic models to problems of ater quality control was discussed. The objective f the model was to determine the least cost cominations of waste water treatment and flow augentation required to maintain a specified stream uality. A Markov process was used as the basis of me stochastic optimization models for estimating e cost resulting from the imposition of probaistic flow augmentation requirements for wnstream water quality control. Given the inimum-cost function for various flows and their robabilities, the 'design' streamflow as well as the egree of waste water treatment at each source of aste within a river basin could be simultaneously xamined to determine the least cost combination f waste water treatment and flow augmentation equired to maintain specified water quality stanards. (Thiuri-Cornell)
/69-09360

YSTEMS ANALYSIS OF THE ASSIMILATIVE APACITY OF STREAMS,
ublic Health Service, Philadelphia, Pa. Delaware stuary Comprehensive Study.
obert V. Thomann.
roc Second Annu Water Quality Res Symp, Alany, NY, p 31-47, April 1965. 17 p, 5 ref.

escriptors: *Systems analysis, *Water quality ontrol, *Linear programming, *Optimization, Waste assimilative capacity, Mathematical odels, Delaware River, Pollution control, Oxygen emand, Administrative costs.

he basic concepts of systems analysis and their aplication for solving water pollution control roblems were presented. A mathematical model as developed to solve water quality problems of e Delaware estuary using linear programming echniques. The goal of the study was to develop echniques for minimizing the overall cost of improving water quality in a situation where there ere many waste sources all contributing in various egrees to the oxygen demand. It was shown that e techniques employed were useful in placing arious water pollution problems (including the assical oxygen demand sag) in an analytical put-output framework which could then be rther utilized in the formulation of optimum ater pollution control policies. It was also shown at a variety of additional waste removals was ecessary at each of the seven waste sources, that e Delaware estuary had many levels of waste asmilative capacity and that there were obvious oblems associated with the least cost solution. hiuri-Cornell)
'69-09374

OR BETTER POLLUTION CONTROL.
extile Industries, Vol 133, No 6, p 65-69, 1969. 5

escriptors: *Textiles, *Biochemical oxygen deand, *Water pollution sources, Activated sludge, emical wastes.
entifiers: *Starch, *Textile wastes, Textile sizes, arboxymethyl cellulose, Polyvinyl alcohol, yestuffs.

rticle based on staff interview at Industrial Waste aboratory, Wesleyan University, Middletown, nn. It is maintained by Conn. Water Resources mmission. The trend from cotton and wool to an-made fibers in past 15 years has reduced water llution. Examples: Cotton mill previously eraged 100-200 lb BOD/1000 lb cloth, now out 50 lb. Starch size being replaced by carboxethyl cellulose (CMC) and polyvinyl alcohol (PA); acetic acid by ammonium sulfate; soaps by odegradable detergents; 50-100 gal water/lb th dropped to 3 to 10 gal. Most textile treatment ants remove 90% plus BOD and 50-80% of color $1.00 to $4.00/1000 lb cloth by activated sludge ocess. Effluent is often treated with chlorine and flocculant may be used in tertiary treatment. Article recommends four steps to textile plant facing pollution problem: (1) Employ a knowledgeable consultant; (2) Make a BOD survey and chemical process balance; (3) Reduce water usage and amount of high BOD chemicals. It is emphasized that the textile mills should work with municipalities to develop mutually advantageous cooperative systems of waste disposal. Constant care is needed in the use of new chemicals to prevent unexpected pollution problems. (Work-NC Stat Univ)
W69-09375

FOND DU LAC METROPOLITAN SEWERAGE DISTRICT V CITY OF FOND DU LAC (ESTABLISHING A SEWAGE DISTRICT).

166 NW 2d 225-230 (Wis 1969).

Descriptors: *Wisconsin, *Sewage districts, *Pollution, Judicial decisions, Sewage systems, Legal aspects, Urbanization, Public health, Cities, Local governments, Sewage disposal, Taxes, Administrative agencies, Legislation.
Identifiers: *Metropolitan sewer district, *Annexation.

The department of resource development ordered plaintiffs to solve their pollution problem. Plaintiffs, to avoid annexation by the defendant city, petitioned the courts to establish a metropolitan sewerage district. A state statute authorized such establishment upon a showing of need and fulfillment of procedural requirements. The defendants opposed this petition since it meant the furnishing of city facilities to town residents who paid no city taxes. The defendant argued that the statute was an unconstitutional delegation of legislative authority. The court found for the defendant. The court would have to answer 'What will be best.' and 'What should be.' in implementing the statute. These were clearly questions of policy that should be left to the legislature. Thus, the court felt that the statute was an unconstitutional delegation of legislative authority. The court did not decide the constitutionality of the districts, but only the method of their establishment. (Gadd-Fla)
W69-09415

WATER POLLUTION.

Vt Stat Ann tit 18, secs 1201-1217 (1968).

Descriptors: *Vermont, *Water pollution, *Administrative agencies, *Water pollution control, Regulation, Legislation, Legal aspects, Water law, Water policy, Jurisdiction, Judicial decisions, Water quality, Standards, Water quality control, Adminsitration, Administrative decisions, Riparian rights, Water rights, Environmental sanitation, Impaired water quality, Public health, Wastes, Water resources, Water utilization.

The state Board of Health has the duty of overseeing the sources, uses and quality of the water supply of towns, villages and public institutions in the interest of public health. It may prohibit the use of water from any source which examination shows not to be fit for public use. The Board may establish necessary regulations in this regard and advise individuals and villages on health considerations of proposed water and sewer systems. The discharge of sewage, drainage or other material which may cause pollution of any source of water for public use in prohibited. The court of chancery, upon application by the Board or any interested party, has jurisdiction over enforcement of rules and regulations promulgated by the Board and may restrain the use or occupancy of premises where violations are taking place until orders or regulations are compiled with. (Johnson-Fla)
W69-09420

FEDERAL WATER POLLUTION CONTROL.
Ill Ann Stat ch 19, secs 145.19-145.22 (Smith-Hurd 1963).

Descriptors: *Illinois, *Water pollution control, *Federal government, *Administrative agencies, State governments, Legislation, Local governments, Water pollution, Water pollution treatment, Pollution abatement, Project planning, Project purposes, Government finance, Government supports, Cooperation, Legal aspects.
Identifiers: *Water Pollution Control Act.

The Sanitary Water Board is designated as the water pollution agency for the state and for purposes of the federal Water Pollution Control Act 1948. In addition to other action necessary to carry out the above purposes, the Sanitary Water Board may: (1) cooperate with the Surgeon General of the United States and state or federal agencies pertaining to matters relating to water pollution; (2) apply for and receive federal funds under the Water Pollution Control Act; (3) approve projects for which application for loans is made under the Water Pollution Control Act by any municipality or agency; and (4) participate in proceedings under the Water Pollution Control Act and give consent to requests by the federal Security Administrator to the Attorney General of the United States for bringing suits for pollution abatement. (Kahle-Fla)
W69-09423

PURIFICATION OF WATERS--DRAINAGE OF PONDS.

Ill Ann Stat ch 24, sec 11-20-4 (Smith-Hurd 1962).

Descriptors: *Illinois, *Drainage, *Ponds, *Water purification, Watercourses (Legal), Canals, Land, Real property, Landfills, Abatement, Public health, Water quality, Legislation, Cities, Regulation, Water quality control, Local governments, Legal aspects.

The corporate authorities of each municipality may provide for the cleansing and purification of waters, watercourses and canals and, when necessary to prevent or abate a nuisance, may provide for the drainage and filling of ponds on private property. (Shevin-Fla)
W69-09434

DISCHARGE OF SEWAGE INTO OPEN DITCHES ALONG STREET OR HIGHWAY.
Ill Ann Stat ch 121, sec 9-123 (Smith-Hurd 1960).

Descriptors: *Illinois, *Drainage, *Sewage disposal, *Highways, Ditches, Legislation, Sewage, Septic tanks, Sewage effluents, Sewage treatment, Domestic wastes, Industrial wastes, Drains, Drainage systems, Adjudication procedure, Administrative agencies, Cities, Local governments, Jurisdiction, Legal aspects.
Identifiers: *Highway drainage, Penalties (Criminal).

No person shall discharge any sewage of any type, or cause the same to be discharged into open ditches, drains or drainage structures installed for highway drainage purposes. Persons violating this section are subject to fine. The highway authority having jurisdiction over any street affected by the violation may enter a complaint in the proper court. If the authority fails to act, any other person may enter such complaint. (Shevin-Fla)
W69-09440

POLLUTION CONTROL EFFORTS: 'TELL THE WORLD ABOUT IT'.

Textile Industries Vol 133, No 6, p 71-73, 1969. 3 p.

Descriptors: *Textiles, *Water pollution sources.
Identifiers: *Textile wastes.

A resume of a joint AATCC-U.S. Depts Commerce and Interior symposium on pollution control in the textile industry, Feb. 26-28, 1969. See Textile Chemist and Colorist, Vol. 1, No. 6, 142/21-156/35 and No. 7, 173/25-187/44, (1969). (See also W69-08551 thru W69-08558). (Work-NC State Univ)

W69-09444

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

MAKING ANALYTICAL TOOLS IN WATER RESOURCES MANAGEMENT USABLE,
TRW Systems Group, Redondo Beach, Calif.; and San Bernardino Valley Municipal Water District, Calif.
M. L. Frankel, and J. A. Beaver.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 431-438, 1968. 8 p, 1 tab, 4 ref.

Descriptors: *Water management (Applied), *Computers, *Data processing, *Model studies, Mathematical models, Analog models, Analog computers, Digital computers, Systems analysis, Operations research, Optimization, Simulation analysis, Management, Analytical techniques, Water resources development, Linear programming, Dynamic programming.
Identifiers: Water resources management techniques.

In the last ten years a formidable array of analytical tools has been developed in an attempt to manage water resources and water quality problems. In the past, each of these tools has come about as the result of a specific study directed at a specific set of problems. In order for the planners and managers to derive the maximum benefit from these past developments, an orderly classification scheme may be used to relate the specific conditions and problems of a region to the existing body of analytical tools, including mathematical models and computer simulations. In addition, the classification scheme permits an organizational outline for structuring the types of studies required in water resources and water quality management. (Knapp-USGS)
W69-09189

PRINCIPLES OF MODELLING AND PROSPECTS OF USING ELECTRONIC COMPUTERS IN HYDROLOGICAL FORECASTING,
Hydrometeorological Service of the USSR, Moscow.
E. G. Popov.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 448-455, 1968. 8 p, 6 ref.

Descriptors: *Forecasting, *Computers, Analog computers, Digital computers, Data storage and retrieval, Data processing, Flood forecasting, Streamflow forecasting, Hydrologic data, Gaging stations, Model studies, Mathematical models.
Identifiers: *USSR, Hydrologic data processing, Hydrologic forecast service.

The use of computers in the USSR for operational application in hydrological forecasting, particularly for snowmelt-rainfall-streamflow relations, is discussed. Flood models, numerical procedures, and determination of parameters for the forecasting of hydrologic events are described. Digital, analog, and hybrid computers are being developed and used for forecasting. Data storage, transmission, and processing are aided by computers working in the country's basic hydrologic data network. (Knapp-USGS)
W69-09191

RUNS OF PRECIPITATION SERIES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering; and Colorado State Univ., Fort Collins. Dept. of Mathematics and Statistics.
For primary bibliographic entry see Field 07B.
W69-09250

A GAME THEORY APPROACH TO THE PROBLEMS OF INTERNATIONAL RIVER BASINS,
Harvard Univ., Cambridge, Mass.
Peter Rogers.
Water Resources Research, Vol 5, No 4, p 749-760, Aug 1969. 11 p, 3 fig, 4 tab, 9 ref.

Descriptors: *Optimization, *Optimum development plans, Linear programming, Mathematical model, Multipurpose development, Water Management (Applied), Flood control, Systems analysis, Simulation.
Identifiers: *Optimizing models, *Game theory, Lower Ganges, Brahmaputra.

The lower Ganges and the Brahmaputra rivers flow out of India and join together in the province of East Pakistan to form one of the major river systems in the world. Each year the rivers flood during the monsoon, causing loss of life and great damage to crops and property. The problem is futher excerbated by the fact that the best flood control points in the basin are not under the political control of Pakistan, which suffers most from the floods. The number of possible combinations of structural and non-structural variables for this river system is so large that conventional methods of analysis are inadequate. We demonstrate that by use of systems analysis techniques, including linear programming and game theory, we are able to consider a rational plan to control the floods while taking advantage of the possibilities for multi-use projects including flood control and other uses for the river, such as power production, irrigation, navigation, and salinity control. Moreover, using the concepts of game theory we are able to investigate a range of strategies for cooperation between the two riparian nations which will result in significant benefits to each. (Marriott-Chicago)
W69-09327

DAILY STREAMFLOW SIMULATION,
Sacramento State Coll., Calif.
Kip Payne, W. R. Neuman, and K. D. Kerri.
J Hydraul Div ASCE, p 1163-1179, July 1969. 17 p, 2 tab, 15 fig, 19 ref.

Descriptors: *Streamflow forecasting, *Simulation analysis, *Markov processes, *Regression analysis, *Optimization, Water quality control, Flood routing, Flow measurement, Hydrographs, Gaging stations, Monthly, Peak flow.

A daily multiple-station streamflow simulator was developed using a first order Markov chain and regression analysis. The study employed streamflow simulation techniques to get optimal flood regulation and routing for water quality control and fisheries during low flow periods. Historic flow records on the Calapooia River in Oregon were analyzed and the hydrographs rearranged to reduce the observed variations of flow within any particular day and between each day. Rearrangement of flows consisted of distributing the monthly peak or peaks of the hydrographs about particular days in order that the ascension and recession curves of the arranged flows occurred on particular days. Daily flows were simulated on the basis of the statistical properties of the rearranged flows. A dampening factor was introduced into the simulator for the purpose of producing non-historic flow sequences with statistical distributions similar to the historic distributions for the annual flows. (Thiuri-Cornell)
W69-09355

AN EFFICIENT PROGRAM OF WATER RESOURCE DEVELOPMENT IN A FRAMEWORK OF GROWTH AND TRADE,
California Univ., Berkeley; and Resources for the Future, Inc., Washington, D.C.
Pinhas Zusman, and Irving Hoch.
Amer J Agr Econ, Vol 50, No 5, p 1635-1646, Dec 1968. 12 p, 1 tab, 1 fig, 15 ref.

Descriptors: *Dynamic programming, *Capital, Water resources, Optimization, Leontief models, Water supply, Mathematical models, Investment, Interest, Planning, Growth rates, Constrai
California.

A dynamic programming model in which exist capital capacities and available primary resour served as constraints was developed. It was appl to the problem of water resources developmen the State of California in a general equilibri analysis which considered all sectors of the eco my simultaneously. The objective of the study to determine an optimum program of trade and vestment, including investment in water resou systems. The Leontief Model analytical techni was employed and the period from 1955 thro 1961 was studied in order to allow comparison actual performance of the economy. The m striking finding was that despite the high rate economic growth (6.6 per cent annual rate growth in state income) the economically effici water supply was practically stagnant. The exist capacity of the medium-cost water-supplying dustry was not utilized at all and at times (19 1959) even the low cost water supply capacity not fully exploited. (Thiuri-Cornell)
W69-09362

SIMULATION OF FLOOD FLOW DIVERSI FROM A LAKE SYSTEM,
Southern Methodist Univ., Dallas, Tex. Inst Tech.; and Northwestern Univ., Evanston, Technological Inst.
Jerry R. Rogers, and Robert S. Gemmell.
Proc, Third Annu Amer Water Resources Cont 285-294, Nov 1967. 10 p, 2 tab, 3 fig, 3 ref.

Descriptors: *Simulation analysis, *Flood cont *Stochastic processes, *Lake Michigan, Mo Carlo method, Hydrograph analysis, Diversi State-discharge relations, Flood routing, Overflo
Identifiers: The Chain of Lakes.

A simulation model based on flooding on the Ch of Lakes (Grass, Fox, Nippersink and Pistak Lakes) and the assessment of flow diversion Lake Michigan as a means of reducing flo damages was developed. The study was directed the evaluation of water export as a means for c trolling floods on a small lake system. Stocha flood simulations were based on the history of l level fluctuations and an estimate of the st volume relationship for the lakes. The lake d was reduced to probability distributions and flo generated by Monte Carlo (random number) sa pling techniques. A generated large flood sequer was selected for sensitivity analysis of divers capacity and overflow elevation. The flood p reduction results with changing diversion size w exhibited. The hydrographs showed that a sm change in diversion size would not appreciat alter the flood peak. The use of General Purp Systems Simulation language facilitated the c struction of the computer model for simulation lake flooding and diversion. (Thiuri-Cornell)
W69-09365

OPTIMIZATION OF WATER PLANNI USING A SPECIAL PURPOSE COMPUTER,
Technion - Israel Inst. of Tech., Haifa. Dept. Agricultural Engineering; and Elbit Compu Ltd., Haifa (Israel).
D. Karmeli, A. Shani, and Y. Gadish.
IFAC, Haifa Symp Comput Contr Nat Resour Public Util, Sept 1967. 52 p, 7 fig, 4 ref.

Descriptors: *Optimization, *Linear programm *Mathematical models, *Water management (plied), *Irrigation efficiency, Computers, Plann Network design, Topography, Data storage retrieval.

The factors that influence income, expenses expected profit were examined in a study direc to the formulation of linear programmi techniques to determine the allocation and production factors that would lead to optima rigation methods and water planning. Using a c puter, detailed water planning was combined

e basic solution for the production factors. Water ocation detailed to the hourly supply was ecified with consideration of the existing net- ork, the topography, the daily consumption and e irrigation system. Calculations of optimal water anning were presented in the appendix. The pos- ility of using an inexpensive computer for the lculations was examined. (Thiuri-Cornell)
69-09367

IE APPLICATIONS OF THE TECHNIQUES SPACE TECHNOLOGY TO WATER ESOURCE CONTROL,
RW Systems, Redondo Beach, Calif.; and TRW stems, Houston, Tex.
A. Aseltine, and C. V. Stableford.
AC, Haifa Symp Compu Contr Nat Resources, blic Util, September 1967. 15 p, 4 fig.

escriptors: *Optimization, *Water resources, Mathematical s, *Digital computers, *Systems alysis, Monitoring, Design, Size, Locating, Time alysis.
entifiers: Space technology.

e possibility of applying space technology chniques to solve water resource problems was scussed. The objective of the study was to employ athematical expressions and digital computer in- uctions used for solving space problems for unching an attack on the problems of water source control. Systems design techniques con- ting of prediction models would be employed to nerate time projections of levels and flows under rious conditions. The guidance and control chniques could be applied to control flows within water system. Optimization techniques would be plied to such problems as location and size of a m or interconnection between basins, or for the termination of the best number and locations of onitoring instruments. (Thiuri-Cornell)
69-09368

HE OPTIMAL YIELD OF AN AQUIFER,
chnion - Israel Inst. of Tech., Haifa.
Bear, and O. Levin.
t Ass Sci Hydrol, Symp Haifa, p 401-412, March 67. 12 p, 5 fig, 4 ref.

escriptors: *Optimization, *A quifer charac- ristics, *Groundwater recharge, *Distribution tterns, *Markov processes, Pumping plants, anning, Mathematical models, Constraints.

athematical programming techniques were em- oyed to establish the criterion of 'optimal yield' ther than 'safe yield' for planning the utilization groundwater aquifers. The planning criterion s the maximization of the objective function sub- t to all constraints involved. The problem of unning the groundwater utilization was formu- ed with this criterion. The proposed approach s introduced through the analysis of a simple odel representing a homogeneous strip of a astal aquifer, which included a pumping and harge installation. The problem of the optimal eration of the system during a given number of te units was presented as a conditional planning oblem. Once the rules of the optimal operation of system for the various seasons as well as the ini- l conditions were known, it was possible to com- te, using a deterministic model, all future states the system. The distribution functions could be ewise computed using a stochastic model incor- rating Markov chains. Quantities of water to be mped and recharged in the future could be ilarly estimated. (Thiuri-Cornell)
69-09371

STEMS ENGINEERING AND AQUIFER ANAGEMENT,
chnion - Israel Inst. of Tech., Haifa.
than Buras.
Ass Sci Hydrol, Symp Haifa, p 466-473, March 67. 8 p, 2 fig.

Descriptors: *Linear programming, *Dynamic programming, *Simulation analysis, *Optimization, *Aquifer characteristics, Mathematical models, Subsurface waters, Water resources development, Annual costs, Design criteria.
Identifiers: Southern California, Indus Valley, Israel.

The application of linear programming, non-linear programming, dynamic programming and simulation techniques for determining least cost operation rules for the coordination of surface and subsurface water resource facilities was presented. Three examples of aquifer management using systems approach in Southern California, in the Indus Valley and in Israel were given. In Southern California simulation techniques were used for the derivation of operating policies. For the Indus Valley mathematical models were constructed for the various components of a complex hydro-agronomic system. These models were evaluated through simulation. In Israel a sequential decision problem was analyzed using dynamic programming. In all cases, however, the aquifers were viewed as components of complex water resource systems. Their utilization was optimized within the overall system. In two of the examples (Indus Valley and Israel) quality considerations weighed heavily in the derivation of design criteria on operation rules. (Thiuri-Cornell)
W69-09373

6B. Evaluation Process

WHAT PRICE A QUALITY ENVIRONMENT,
For primary bibliographic entry see Field 05G.
W69-09063

LAND, WATER, AND SOCIAL INSTITUTIONS,
Carnegie-Mellon Univ., Pittsburgh; and Arizona Univ., Tucson.
Courtland L. Smith, and Harland I. Padfield.
IN W.G. McGinnies and B.J. Goldman, Eds., Arid Lands in Perspective, p 325-336, University of Arizona Press, Tucson, 1969. 12 p, 36 ref.

Descriptors: *Water resources development, *Social aspects, Geographical regions, Institutional constraints, Institutions, Optimum development plans, Planning, Project planning, Coordination, Social participation, Social function, Tennessee Valley Authority Project, Social function, Metropolitan Water Dist. of So. Cal.
Identifiers: Salt River Valley (Ariz), Gezira Scheme, Sudan, Yaqui River Basin, Mexico, Niger River Project, Sudan, Israel.

This paper emphasizes the need to consider social institutions and cultural diversity in the development of world water resources. Understanding of human behavior requires focusing on both the people-in-action or the system of action and the blueprint for behavior or the culture of the people. Most social institutions have both an integrative function and a boundary maintenance function. For water resource development the closeness of the unity between the territoriality of the people-in-action and the spatial availability of the water affects the success of the water development scheme. The waterspace concept states that for each economic development scheme, careful and detailed study must be made of the territorial and cultural aspects of the social institutions involved. A case history of waterspace is traced in the development of the Salt River Valley of Arizona. Several other examples are provided from culturally divergent and geographically widespread areas. The importance of cultural factors is shown in examples from the water development problems of several countries. Successful economic development is enhanced where careful consideration is given to the territoriality of the existing and created social institutions. The blueprint for behavior of people occupying a given waterspace must complement demands of development. (See W69-09210). (Sherbrooke-Ariz)
W69-09214

HISTORICAL BACKGROUND AND PHILOSOPHICAL BASIS OF REGIONAL WATER TRANSFER,
Idaho Univ., Moscow. Water Resources Research Inst.
C. C. Warnick.
IN W.G. McGinnies and B.J. Goldman, Eds., Arid Lands in Perspective, p 340-352, University of Arizona Press, Tucson, 1969. 13 p, 6 fig, 1 tab, 62 ref.

Descriptors: *Water transfer, *Inter-basin transfers, Arid lands, Southwest U.S., Distribution patterns, Import, Irrigation canals, Water conveyance, Water demand, Water distribution (Applied), Arizona, California, Future planning (Projected), Projected benefits, Projected planning, Human population, Social aspects, Federal jurisdiction, History, Colorado River.

It is concluded that a regional water transfer, although difficult to define, does entail out-of-basin diversion and has a noticeable impact on the socio-economic well being of the area. An historical review, beginning 6,000 yrs. ago in the Near East, concludes with descriptions of the Colorado River Aqueduct and the Rocky Mountain Trans-mountain Diversions. Population increase, economic growth and the solution of the Arizona Valley Cal., et al case related to Colorado River water allocation has resulted in development of many conceptual plans for rather vast regional water transfer. Information on these projects has been summarized in a table. The philosophical justification for regional water transfer is discussed in terms of the following: (1) regional growth and economic expansion, (2) social welfare, (3) wisdom of visionary leaders, (4) agencies ambition and (5) professional challenge. Present authorities advocate more study and are seeking more alternatives for the solution of water needs in arid-land regions. Time required for planning and accelerated technological change make it difficult to reconcile the problem of water needs at hand. (See W69-09210). (Sherbrooke-Ariz)
W69-09215

ECONOMICS OF LARGE-SCALE TRANSFERS,
Resources for the Future, Inc., Washington, D.C.
Charles W. Howe.
IN W.G. McGinnies and B.J. Goldman, Arid Lands in Perspective, p 374-382, University of Arizona Press, Tucson, 1969. 9 p, 4 tab, 20 ref.

Descriptors: *Interbasin transfers, *Cost-benefit analysis, Water transfer, Arid lands, Export, Import, Cost comparisons, Project planning, Water costs, Long-term planning, Project benefits, Short term planning, Comparative costs, Cost-benefit theory, Direct benefits, Direct costs, Economic evaluation, Economic justification, Estimated benefits, Indirect benefits, Indirect costs, Agriculture, Irrigation water.

Current projects of interbasin transfer of water differ from past projects by increased size and higher potential for conflict between exporting and importing regions. This paper sets out to answer the questions, 'Are total social benefits from the transfer sufficient to offset the total costs,' and 'Will water users be able and willing to pay a price for water which will cover project costs'. Empirical studies show direct benefits to be fairly low compared to prospective costs of new water supplies. This implies that the economic feasibility of new supplies will depend upon indirect benefits and that user charges sufficiently high to cover the costs of providing the water will probably not be possible. Secondary benefits are analyzed and the possibility that they are balanced by secondary disbenefits is considered. Empirical studies of total benefit show that the period of immobility is a crucial factor which must be studied carefully. The costs of several proposed large-scale transfers are presented. Estimates of costs and benefits suggest that large-scale transfers are at best marginal for all areas at present, but that their use in providing water for already established, highly specialized agricultural areas which will be exhausting their

water supplies in an area of potential application. (See W69e09210). (Sherbrooke-Ariz)
W69-09219

PHILOSOPHICAL CONSIDERATIONS OF WATER RESOURCE IMPORTATION,
Dean F. Peterson.
IN W.G. McGinnies and B.J. Goldman, Eds., Arid Lands in Perspective, p 398-405, University of Arizona Press, Tucson, 1969. 7 p, 18 ref.

Descriptors: *Water transfer, *Ethics, *Water allocation (Policy), Arid lands, Interbasin transfers, Decision making, Local governments, Social values, Water resources development, Water pollution effects, Political aspects, Political constraints, Legal aspects, Social aspects, Conservation.
Identifiers: Philosophical considerations.

This paper is concerned with two related topics; (1) the ethical dimensions of the concepts of minimizing man's interference with nature in constrast to his desire to conquer nature, and (2) the ethical concepts related to our historical water policies and their relation to the concept of large-scale water transfer. The man-nature theme vs. conquest of nature and the ethics of pollution problems are discussed. The history of U.S. water policy, a reflection of philosophy, is traced. Political equity and income redistribution are discussed in relation to policy formation. Benefits from water importation are considered in terms of regional differences in states of development. The importance of real objectives (vs. procedures) and sovereignty is related to water decision making. General solutions based on ethical considerations do not appear possible, but every effort should be made to construct and debate ethical arguments in both generalities and for specific cases so that our decisions might be the best possible. (See W69-09210). (Sherbrooke-Ariz)
W69-09221

CANADIAN WATERS AND ARID LANDS,
Department of Energy, Mines and Resources, Ottawa (Ontario).
E. Roy Tinney, and Frank J. Quinn.
IN W.G. McGinnies and B.J. Goldman, Eds., Arid Lands in Perspective, p 411-415, University of Arizona Press, Tucson, 1969. 5 p, 2 tab, 3 fig.

Descriptors: *Water transfer, *Water policy, United States, Interbasin transfers, Water resources development, Legal aspects, Economy, Governments.
Identifiers: *Canada.

This paper attempts to present Canadian thinking and positions on the possibility of international large-scale transfer of Canada's water resources. It is emphasized that no official contact has been made between governments on this subject and that all water authorities in the U.S. are not convinced of the need for international diversion. Some of the major points in Canadian thinking are: (1) Canadian waters are a national, not a continental, resource; (2) no market presently exists for Canadian water in the U.S.; (3) Canada would be unwilling to sell water until completion of an inventory of its own future needs; (4) Canada is presently inventorying water resources; (5) both federal and provincial governments in Canada must concur on any negotiations; (6) sale conditions could not jeopardize permanent ownership and repatriation if and when needed in Canada. It is apparent that the question of exporting Canadian water to the U.S. arid lands is premature: quite simply, there is no buyer and no seller. (See W69-09210). (Sherbrooke-Ariz)
W69-09223

THE ROLE OF THE ECONOMIST,
Oregon State Univ., Corvallis. Dept. of Agricultural Economics.
Bruce R. Beattie.
IN W.G. McGinnies and B.J. Goldman, Eds., Arid Lands in Perspective, p 416-417, University of Arizona Press, Tucson, 1969. 2 p, 4 ref.

Descriptors: *Water transfer, *Decision making, *Economic evaluation, Interbasin transfers, Economic prediction, Economic impact, Economic justification.

This paper discusses the role of the economist in the social decision-making process and how the economist, given the present state of his art, might best fulfill this role with regard to the issue of interbasin water transfer. The economist is obligated to provide positive analysis of the economic implications of alternative social actions and to be careful not to imply or leave the impression that the optimum arrived at, given the technical criteria of economics, has any more or less normative significance regarding the total problem than do optima of other technical disciplines. It is the economist's role to act as an expert consultant to decision-makers, but he can not replace decision-makers. The key economic variables in water transfer are the value productivity of water in the area of destination, the value productivity of water in the area of origin, and the cost of transfer. In addition to recounting the direct and indirect effects, an evaluation of effects due to changes in product and factor prices and determination of proportionate share of the Federal tax burden will be required to provide a complete description of regional income redistributive impacts of water transfers. (See W69-09210). (Sherbrooke-Ariz)
W69-09224

PERCEPTION OF CHOICE AND FACTORS AFFECTING INDUSTRIAL WATER SUPPLY DECISIONS IN NORTHEASTERN ILLINOIS,
Chicago Univ., Ill. Dept. of Geography.
For primary bibliographic entry see Field 03E.
W69-09322

IS PUBLIC INTERVENTION IN WATER RESOURCE DEVELOPMENT CONDUCIVE TO ECONOMIC EFFICIENCY,
John V. Krutilla.
Natural Resources Journal, Vol 6, No 1, p 60-75, Jan 1966. 16 p, 1 tab.

Descriptors: *Economic efficiency, Welfare (Economics), Water resources development, Cost-benefit analysis, Administrative agencies, History.
Identifiers: Income redistribution, Research needs.

The paper reviews the history of propositions in welfare economics which have become firmly established in concept and practice. It raises questions regarding their applicability at this stage in the development of water resources. Public intervention, while necessary, may not be sufficient to improve efficiency in government agencies. Benefit-cost analysis is supposed to provide criteria by which intervention can improve efficiency. However, benefits are typically overstated by the benefit-cost calculation. Income redistribution attending a project should be considered in terms of efficiency but traditionally has not been. The efficiency of the institutional mechanism of public intervention is analyzed. The more established an agency is, the more traditional its goals and approaches are likely to be. A community's growing needs may surpass the capability of its agencies. Pressing research needs include a review of the capabilities of existing agencies, identification of the barriers to improved performance, and consideration of the problem of organizing a capability consonant with present and future needs. Models for study include the cooperative water quality management associations in the Ruhr and the integration of investment planning, design criteria and pricing policy of Electricite de France. (Gossen-Chicago)
W69-09323

WATERCOURSES--RECREATIONAL USE FOR WATER UNDER PRIOR APPROPRIATION LAW,
For primary bibliographic entry see Field 06E.
W69-09324

MUNICIPAL WATER SUPPLY AND RECREATION: ARE THEY COMPATIBLE,
Colorado Univ., Boulder.
Ralph A. Graham.
Water Development Utilization, Conservation, Western Resources Conference, Boulder, Colo, 31-35, 1963. 5 p.

Descriptors: *Multiple-purpose reservoi *Recreation, Water quality, Water supply.
Identifiers: *Community relations, *Citizen's a visory groups.

In response to the question posed, the case of S Diego, California is cited as an example of a situ tion where the two uses have been found to compatible. The author admits, however, to t possibility of this not being true in other jurisdi tions. The present reservoir recreation program San Diego utilizes each of the two impoundi reservoirs in the city's reservoir system. Activiti include fishing, waterfowl hunting, picnicking, hi ing and camping but water contact activities su as swimming, wading and water skiing a prohibited. A program involving such an importa part of the community as its water supply reservo has many community relation problems. The Ci of San Diego has taken a three facet approach solving these problems: (1) appointment of an a visory group of respected citizens to a City Lak Recreation Commission; (2) appointment of a sp cialist in fish and game matters to the city's utiliti department staff; and (3) hard work on the part everyone from the city manager down to t newest laborer to insure a successful reserv recreation program. This includes maintaining good relationship with all of the news media a maintaining good public relations with all t public agencies and citizen's organizations. (Sta Chicago)
W69-09328

OPTIMIZING INVESTMENT IN FLOOD CONTROL AND FLOOD PLAIN ZONING,
Rutgers - The State Univ., New Brunswick, N Water Resources Research Inst.
For primary bibliographic entry see Field 06F.
W69-09330

DEVELOPMENT OF RECREATIONAL AN RELATED RESOURCES AT HYDROELECTRI PROJECTS LICENSED BY THE FEDERA POWER COMMISSION,
Sherman S. Poland.
Land and Water L Rev, Vol 4, No 2, p 375-39 1969. 24 p, 94 ref.

Descriptors: *Water resources developmer *Federal Power Act, *Hydroelectric proje licensing, *Conservation, Recreation, Administr tive agencies, Hydroelectric plants, Multiple-pu pose projects, Fish conservation, Wildlife conse vation, Federal project policy, Project plannin Regulation, Water Resources Planning Act, Leg aspects, Scenery, Transmission lines, Heated wate River basin, Development, Thermal pollution, Pe mits.
Identifiers: *Federal Power Commission, License Licensing.

The purpose of this article is to explore the scop and exercise of the Federal Power Commission authority when licensing hydroelectric projects, assist development of related water resources a to foster conservation measures. The Feder Power Commission is authorized by Congress license all hydroelectric projects to assure co prehensive development of the water resource The licensing was used first to protect navigatio but then extended to projects on private wat

the rationale of interstate trade in electric
The importance of the licensing power is
quirement that projects plan for comprehen-
velopment including recreation and conser-
At first the Commission's policy in aid of
tion at project sites depended on the particu-
uation. Now with the Water Resources
ng Act of 1965 the Commission submits ap-
ons for hydroelectric licenses to the Water
ces Council. The Council reviews water and
source policies of federal agencies with an
sis on conservation and recreation. Besides
sion of license to the Water Resources
il the Commission requires comprehensive
or development of recreation for conserva-
natural resources around the hydroelectric
f the hydroelectric planning does not appear
in the public's interest in development of
tion, conservation of natural resources or
tion of historical sites there is precedent for
of license applications. (Gadd-Fla)
9376

HEASTERN WATER AND RELATED RESOURCES COMPACT.

ev Stat Ann secs 489-A:1 thru 489-A:4
).

ptors: *New Hampshire, *Interstate commis-
*Water resources development, *Project
ng, Legislation, New England, Planning, Ad-
rative agencies, Regulation, Water policy,
istrative costs, Coordination, Federal
ment, State governments, Maine, Connec-
Rhode Island, Vermont, Massachusetts, In-
e compacts, Governors, Financing.
iers: *Northeastern Resources Commission,
heastern Water and Related Land Resources
act.

vernor has the authority to enter into a com-
vith the other New England states to en-
e coordination among its members in formu-
recommendations for the solution of
ms in the field of water and related land
ces. The compact is also to encourage
ration with United States agencies. The
astern Resources Commission is the body
to carry out the purposes of the compact.
tate and the agencies and departments of the
l government involved in water and land
ces shall select one person to represent them
e Commission. The Commission shall make
mendations to each member state and the
l government. The Commission shall: collect
terpret pertinent data; investigate and plan
and related land resources projects; program
nstruction of these projects; and encourage
erral of projects to the Commission. No ac-
f the Commission shall be binding unless
at a meeting in which a majority of members
esent. The Commission is to be financed by
riations from each member state and the
l government. The Commission may sue or
d and may hire personnel necessary to carry-
its duties. This compact shall not impair any
compact already entered. The compact
es effective upon t he entry of three other
and the appointment of the federal represen-
A member may withdraw after three years
(Gadd-Fla)
9395

WARE WATER AND AIR RESOURCES
I'N.

de Ann tit 7, secs 6002-6016 (Supp 1966).

ptors: *Delaware, *Administrative agencies,
liction, *Natural resources, Legislation,
law, Administration, Water policy, Legal
l, Federal government, Water resources
pment, Regulation, Judicial decisions, Per-
inancing, Adjudication procedure, Govern-
nance.
iers: Penalties (Criminal).

The Delaware Water and Air Resources Commission conducts proceedings against violations of the water and air conservation laws of this section and holds public hearings with respect to granting permits, leases and grants authorized by this section. Appeal to the superior court of decisions substantially affecting any person may be had only after prior notification of the commission. Fines are provided and may be assessed against violators of this provision on a per diem basis with each day of continued violation considered a separate offense. The commission may cooperate with and receive moneys from the federal government or any industry or other source. (Johnson-Fla)
W69-09396

BROADWAY LAKE COMM'N, ANDERSON COUNTY.

SC Code Ann, secs 51-211 thru 51-216, 51-218, 51-221, 51-223, 51-225, 51-226, 51-236 (1962).

Descriptors: *South Carolina, *Administrative agencies, *Water policy, *Water resources development, Legislation, Legal aspects, Regulation, Administration, Local governments, Permits, Fishing, Water resources, Resource development, Conservation, Multiple-purpose projects, Riparian rights, Lakes, Recreation, Recreation facilities, Fishing gear.

The Broadway Lake Commission manages and controls Broadway Lake in Anderson County and those park areas in and near said lake. The Commission, with the aid of the county supervisor, sees to the proper improvement, maintenance and supervision of the lake area and also makes rules and regulations necessary to carry out these duties. The Commission may condemn, purchase, lease or otherwise acquire such properties as are needed to create the lake and adjacent park areas. Boathouses and walks built with Commission approval are exceptions to the general prohibition of private building on the lake edge. Fishing is governed by state law and may be done only by hook, pole, line and hook or rod, reel, line and hook. Artificial lights may not be used by fishermen to attract fish. The sheriff and his deputies in Anderson County in cooperation with the lake patrolman are responsible for keeping order around said lake. (Johnson-Fla)
W69-09401

GREAT LAKES BASIN COMPACT.
Ill Ann Stat ch 127, secs 192.1 - 192.4 (Smith-Hurd 1967).

Descriptors: *Illinois, *Great Lakes region, *Interstate compacts, *Water resources development, Legislation, Interstate commissions, Great Lakes, Indiana, Michigan, Minnesota, New York, Pennsylvania, Ohio, Wisconsin, Legal aspects, Navigation, Regulation, Project planning, Conservation, Recreation, Watersheds (Basins), Water management (Applied), Watershed management, Water utilization, Administrative agencies.
Identifiers: *Great Lakes Basin Compact.

The State of Illinois does hereby ratify, approve and adopt the Great Lakes Basin Compact. The purposes of the compact include: (1) the development, use and conservation of the water resources of the Great Lakes Basin; and (2) the securing and maintaining of a proper balance among industrial, commercial, agricultural, water supply, recreational and other legitimate uses of the water resources of the basin. The compact shall be effective when enacted by any four of the participating states. A Great Lakes Commission is hereby created and shall perform enumerated powers within the Great Lakes area and any watercourse or watershed draining in any of these lakes. The Commission shall have, among its other powers, the power to: (1) correlate data relating to water resources; (2) recommend methods for developing and conserving water resources; (3) consider means of improving navigation and fisheries; (4) recommend policies relating to water resources including institution and alteration of flood plains; and (5) recommend to the party states uniform and other laws relating to the basin's water resources. Each party state agrees to consider the action the Commission recommends. Ratification and approval procedures are also provided. (Heckerling-Fla)
W69-09442

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

AN EFFICIENT PROGRAM OF WATER RESOURCE DEVELOPMENT IN A FRAMEWORK OF GROWTH AND TRADE,
California Univ., Berkeley; and Resources for the Future, Inc., Washington, D.C.
For primary bibliographic entry see Field 06A.
W69-09362

OPTIMIZATION OF LONG-RANGE MUNICIPAL MULTI-RESOURCE FISCAL POLICIES,
Service Bureau Corp., Inglewood, Calif.
Charles B. Woodward.
Soc Econ Planning Sci, Vol 1, No 3, p 273-282, July 1968. 10 p, 1 tab, 5 fig.

Descriptors: *Linear programming, *Metropolitan Water Dist. of So. Calif., *Optimization, *Water distribution (Applied), *Water rates, Model studies, Financial analysis, Computers, Budgeting, Interest rate, Investment.

A linear programming model was developed to assist the Metropolitan Water District of Southern California (MWD) in determining the cost of the various fiscal policies. A linear programming matrix using raw data was produced by a matrix generator. The linear programming output was translated by another computer program into budget reports to the board of directors. Two types of input data were required, (a) monetary data of current tax rates and fixed expenditure and receipts, maximum tax water rates, bond interest rates, interest rates earned on investments, and (b) model data consisting of periods, row names, vector names and fixed coefficients. Three studies were made for the MWD and two separate objective functions, minimization of cost to the citizen and minimization of total bond interest cost, were examined. Although the maximum tax rate was unacceptably high, the results obtained for minimizing total tax and water revenues were illuminating. The use of computers facilitated the task. (Thiuri-Cornell)
W69-09363

A MATHEMATICAL THEORY OF COST-EFFECTIVENESS,
INFRET Corp., New York.
Herman Zabronsky.
Soc Econ Planning Sci, Vol 1, No 1, p 3-18, Sept 1967. 16 p, 7 fig, 4 ref.

Descriptors: *Mathematical models, *Cost-benefit analysis, *Budgeting, *Planning, *Optinization, Resource allocation, Decision making, Input-output analysis.
Identifiers: Cost-effectiveness, Gradient Method.

A rigorous mathematical theory of cost-effectiveness, based on Gradient Method, was developed that was applied to obtain quantitative solutions to decision making problems. The problems pertained to planning, programming and budgeting systems that require precise comparison of alternate plans and programs. Cost-effectiveness analysis was used to make such comparisons by relating resource input and useful output of a program relative to stated planning goals. The proper applications of cost-effectiveness depended on their mathematical foundations. (Thiuri-Cornell)
W69-09366

RICE V OAKLAND COUNTY DRAIN COMM'R (ASSESSMENTS MUST BEAR RELATIONSHIP TO BENEFITS).

168 NW 2d 302-304 (Ct App Mich 1969).

Descriptors: *Michigan, *Assessments, *Benefits, *Property values, Appraisals, Evaluations, Condemnation, Compensation, Lakes, Riparian land, Judicial decisions, Legal aspects, Remedies, Water levels, Real property, Administrative agencies, Administrative decisions, Adjudication procedure.

A special assessment district was established in 1963 to fix and maintain the water level of Lower Straits Lake. The original assessment made by defendant commissioner on plaintiffs' land was $2,264.75. As the result of a petition by plaintiffs, a board of review revised this special assessment at a reduced sum of $1,265. Plaintiffs appealed to the circuit court. That court found the revised assessment to be equitable and reasonable under the circumstances. From this decision plaintiffs appealed, contending that the stabilization of the water level of the lake did not increase the value of their property since special soil conditions made the property unsuitable for the construction of buildings and residences. The court affirmed the circuit court's decision. The court agreed that an assessment to be valid must relate to the benefit which reasonably applies to the subject property. It found evidence that the board of review had taken into account the special soil conditions in revising the assessment. The court found insufficient evidence to negate the conclusion that the revised assessment accurately reflected the equitable benefit derived by the plaintiffs from the stabilization of the lake water level. (Gabrielson-Fla)
W69-09408

IMPERIAL REFINERIES OF MINNESOTA INC V CITY OF ROCHESTER (ASSESSMENT FOR SEWER AND WATER IMPROVEMENTS).
165 NW 2d 699-703 (Minn 1969).

Descriptors: *Minnesota, *Assessments, *Sewers, Judicial decisions, Conduits, Project benefits, Cities, Water tanks, Legal aspects, Local governments, Evaluation, Taxes.
Identifiers: Water mains.

Defendant city assessed plaintiff's property for sewer and water improvements. Plaintiff appealed claiming that the failure of defendant to give notice of the final assessment made the assessment unconstitutional. Plaintiff also claimed that the city is estopped from denying that it proceeded under a repealed statute since such statute was erroneously designated by the city clerk. Finally, the plaintiff claimed that the assessments were improperly allocated. The court found for the defendant. The court decided the first contention had no merit since plaintiff's full participation in previous proceedings was sufficient notice. Even without sufficient notice, plaintiff's full hearing on the merits was held to be a waiver of any objection. Plaintiff's failure to rely on the erroneous designation was held to invalidate his second contention. The third contention was held to be without merit since the alleged improper allocation was in fact due to dissimilar benefits. In addition, property given a lower assessment was outside the city and its owners had assumed the assessment. (Gadd-Fla)
W69-09412

6D. Water Demand

DETERMINANTS OF PROPERTY VALUE ON ARTIFICIAL LAKES,
E. L. David, and W. B. Lord.
University of Wisconsin, Dept of Agricultural Economics, No 54, May 1969. 55 p, 12 ref.

Descriptors: *Water allocation (Policy), *Water resources development, *Recreation demand, *Artificial watercourses, Property values, Lakes, Watercourses (Legal), Value, Market value, Shores, Lake shores, Riparian land, Recreation, Wisconsin, Resources development, Resource allocation, Water demand, Water values, Access routes, Topography, Water pollution, Population, Density, Surface waters.

The public demand for water recreation areas, as measured by examining the market values of waterfront property is used as an aid to guide future water resource development. The accuracy of such a study is somewhat limited in that it only registers the demand of that segment of the population which can afford to purchase waterfront property. The authors explain the criteria for choosing the sample and for determining the property values. The patterns of the rising demand for riparian land are examined. A statistical analysis of the effect of factors influencing development is presented including an examination of land value, value of improvements, number of improvements per acre, topography, ease of access, pollution, proximity to population centers, amount of surface water in vicinity, and amount of privately owned shoreline. The data presented is summarized and conclusions are drawn. (Gabrielson-Fla)
W69-09065

WATER USE IN THE MINERAL INDUSTRY,
Bureau of Mines, Washington, D.C. Div. of Economic Analysis.
Alvin Kaufman, and Mildred Nadler.
Bur Mines Inform Circ No 8285, 1966. 58 p, 15 fig, 24 tab, 8 ref, 2 append.

Descriptors: *Water utilization, *Mineral industry, Mining, Sands, Gravels, Iron, Phosphates, Reclaimed water, Water reuse, Waste water treatment.
Identifiers: Mineral industry water use.

To aid industry and Government in planning water developments the Bureau of Mines in 1963 canvassed mineral producers to determine water use in 1962. Water used by the mineral industry is only 2% of the water withdrawn by all industry. The major water-using mineral industries are natural gas processing, phosphate rock, sand and gravel, and iron ore. Total water use and new water intake is dependent on the quantity of material processed and the process water requirements of the particular industry or commodity. Recirculation is dependent on the processing requirements of the particular commodity, the manner in which the water is used, cooling and condensing requirements in large industries, the quality of new water intake, and the need to treat new discharged water. Consumed water is dependent on the quantity of water recirculated, the temperature and humidity in the area, and the proportion of water used for cooling and condensing. A threefold increase in water use by the mineral industry by 1985 is forecast. (Knapp-USGS)
W69-09201

PANEL DISCUSSION-INTRODUCTORY REMARKS,
Water Resources Council, Washington, D.C.
Henry P. Caulfield, Jr.
IN W.G. McGinnies and B.J. Goldman, Eds., Arid Lands in Perspective, p 406-411, University of Arizona Press, Tucson, 1969. 6 p, 10 fig.

Descriptors: *Water resources planning, Human population, Economy, Long-term planning, Decision making, Administration.
Identifiers: Federal-state planning, *First National Assessment of the Nation's Water Resources, *Water Resources Council.

The paper presents background information relating to the First National Assessment of the Nation's Water Resources by the Water Resources Council and to the Federal-State comprehensive framework planning program underway and projected for the U.S. under the aegis of the Water Resources Council. Long-term projections, used as guidelines for public programs, reflect the fact that the Nation has no policy or plan at the present time to slow down or stabilize either population or econo growth. Need for such a policy or plan in respo to concern with human ecology possibly should the subject of widespread national discussion of official concern. Until such a policy is for lated and implemented, responsible pu planning within a functional area must be ba upon what appears to be future reality un established policies, mores, and conditions. council adopted 20 major river basins and regi for study, major topics considered are listed programs in progress are outlined. 17 topics which express findings and recommendations w given are listed, one of which agricultural w management policy, has been recommended fo special national study. The Council's compreh sive planning program is clearly laying a founda for analysis of large scale transfer needs, if a (See W69-09210). (Sherbrooke-Ariz)
W69-09222

HYDROGEOLOGICAL STUDIES FOR DRIN ING WATER SUPPLY OF CRAIOVA C (ROMANIAN),
For primary bibliographic entry see Field 04B.
W69-09287

WATER REQUIREMENTS AND USES WYOMING MINERAL INDUSTRIES,
Bureau of Mines, Denver, Colo. Dept. of Engine ing.
Millard M. Gilkey, and Ronald B. Stotelmeyer.
Bur of Mines Inform Circ No 8328, 1967. 92 p, fig, 4 tab, 18 ref, 1 append.

Descriptors: *Water utilization, *Water requi ments, *Mineral industry, *Wyoming, Data coll tions, Water reuse, Reclaimed water, Surf waters, Waste water treatment, Water law.
Identifiers: Mineral industry water requirements.

A detailed study was made of water usage in Wyoming mineral industry, with projections for future. In 1964, the mineral industries of Wyom used 20 billion gal. of new water, nearly all self-s plied, and reused 72 billion gal, a total usage of billion gal. Consumption amounted to 2.8 bill gal. About half of the 20 billion gal of new wa was obtained from surface sources and the from groundwater. Reported costs, covering po and maintenance, for the self-supplied new wate mineral industry operations ranged from about 20 cents per thousand gal and averaged 8 ce Cost of recirculation of water, including power maintenance, averaged 2 cents. The value product for the entire industry was $25 thousand gal of new water intake and about $ per thousand gal consumed. Wyoming has a wa deficiency but the shortage is less severe than in arid Southwest. The demand for new water will crease from the 20 billion gal used in 1964 to billion gal in 1980. The projected new-wa requirement for the year 2000 is 40 billion gal. napp-USGS)
W69-09294

WATER TRANSFERS.
Washington Univ., Seattle.
Frank Quinn.
Geographical Review, Vol 58, No 1, p 108-1 Jan 1968. 25 p, 3 fig, 4 tab, 87 ref.

Descriptors: *Water transfer, *Water dema Legal aspects, Political constraints, Water rig Municipal water, Industrial water, Competing us Water supply, History.

The paper has two objectives: (1) to develop so perspective on water transfers relative to growth of total, and urban, demands in the W and on alternative means for satisfying them; (2) to discuss the range of legal and political pediments that bear on the flow of water amo different users and regions. The evolution of co petitive demand for water rights is traced; hist cally and currently, a municipal-industrial wa

pply has low priority. Legal and political restric-
ns on the transfer of existing water rights make it
fficult for growing cities to purchase agricultural
ter supplies. States have adopted a 'hands off'
licy on transferring water to other states. Nega-
e aspects of water transfer are summarized, but
gal and political accommodations to transfer are
commended. Extensive research on alternative
lutions to the water crisis should be undertaken.
ossen-Chicago)
69-09325

E. Water Law and Institutions

ATER PLANNING FOR NORTH AMERICA,
nerican Bar Association, Chicago, Ill. Section of
inerals and Natural Resources Law.
axwell Cohen.
BA Section of Mineral and Natural Resources
w (1966 Proceedings), p 21-26, 1966. 6 p.

escriptors: *International law, *Boundaries (Sur-
ces), *International Joint Commission, *River
sins, Legal aspects, Disalination, Columbia River
sin, Navigable waters, Non-navigable waters,
eaties, Planning.
entifiers: North America.

he author discusses the approaches used by vari-
s countries for handling the problems of multina-
nal river boundaries. He touches on the systems
ed by other nations and on the situation as it ex-
s between the United States and Canada. He
ates that in the area of cooperative non-naviga-
nal uses the United States-Canada experience
s become a model to be studied by Europeans.
e considers the boundary waters experience
tween these two nations as having been highly
ccessful. The author fully develops the history of
nited States-Canada relations in this area and
eorizes that resort to the international tribunals
ould not have produced such success. He feels
at these nations have progressed to a point where
ere is recognition of sharing a common continent
d the water programs of these nations have done
uch in that direction. The full ramifications of
is continentalism have not yet developed, but,
hen they do, there should be even more substan-
l continentalist policies. (Shevin-Fla)
69-09059

**OMMONWEALTH V NEW YORK AND
ENNSYLVANIA CO. (EQUITABLE RELIEF
ROM STREAM POLLUTION).**
r primary bibliographic entry see Field 05G.
69-09060

ZING UP ANTI-POLLUTION LEGISLATION,
r primary bibliographic entry see Field 05G.
69-09061

**R POLLUTION, WATER POLLUTION, IN-
JSTRIAL COOPERATION AND THE AN-
TRUST LAWS,**
r primary bibliographic entry see Field 05G.
69-09062

**AN V SHEFFIELD BLDG. AND DEV. CO.
UIT TO ENJOIN DISCHARGE OF SEWAGE).**
r primary bibliographic entry see Field 05G.
69-09064

**ETERMINANTS OF PROPERTY VALUE ON
RTIFICIAL LAKES,**
r primary bibliographic entry see Field 06D.
69-09065

**OMMONWEALTH V TEMPLE COAL CO.
ONSTRUCTION OF SETTLING BASIN PUR-
ANT TO BOARD ORDER).**
District and County Reports 7-25 (CP Pa 1949).

Descriptors: *Pennsylvania, *Flood control, *Streamflow, *Obstruction to flow, Judicial decisions, Settling basins, Desilting, Erosion control, Flow control, Streams, Stream erosion, Flooding, Riparian land, Riparian waters, Legislation, Banks, Bank erosion, Coal mine wastes, Mineral industry, Administrative agencies, Cost allocation.
Identifiers: Culm piles.

Plaintiff coal company owned land through which a stream flowed. Erosion of culm piles on the banks of the stream resulting from heavy rain and flooding caused ensilting in the stream and obstruction of water flow. Under an act making it unlawful to construct an obstruction so as to change the flow of a stream, the water board issued an order requiring the company to construct a settling basin on the stream to intercept flood wash and debris. The company built the settling basin and attempted to force contri bution for costs from an adjacent coal company. The court held that the act did not empower the board to direct a riparian owner to construct any work in any stream or upon his land to prevent flooding. The board's only power was to direct removal of the obstruction. The company that built the settling basin was therefore a volunteer in its actions and could not compel contribution from the other company. (Helwig-Fla)
W69-09066

HOLDERS OF NEW YORK FISHING LICENSES; FISHING IN NEW JERSEY PART OF GREENWOOD LAKE.

N J Stat Ann sec 23:9-126 (Supp 1968).

Descriptors: *New Jersey, *Permits, *Fishing, *Interstate, Bodies of water, Legislation, Equitable apportionment, Water policy, Wildlife conservation, Boundaries (Property), Lakes, Water rights, New York, Legal aspects.
Identifiers: Licenses.

This section exempts citizens of New York who hold New York fishing licenses from the general requirement that everyone who fishes in New Jersey waters must hold a New Jersey license. The exemption applies only to that part of Greenwood Lake which lies in New Jersey and is conditioned with the proviso that the section shall apply only if New York exempts those holding New Jersey licenses when such individuals fish the New York portion of Greenwood Lake. (Blunt-Fla)
W69-09067

ELKHORN COAL CORP. V YONTS (SUIT AGAINST MINERAL OWNER FOR ALLEGED DAMAGE TO WATER WELL).

262 SW 2d 384-385 (Ky 1953).

Descriptors: *Kentucky, *Mining, *Water wells, *Subsurface waters, Deep wells, Underground, Coal mines, Mining engineering, Mineralogy, Salts, Mineral water, Domestic water, Judicial decisions, Legal aspects, Civil law.

Plaintiff landowner brought suit against mineral owner for alleged damages to a water well. Plaintiff claimed that the wrongful mining operations of defendant had caused his well to go dry. On appeal the defendant contended that (1) his mineral deed gave him the right to subterranean waters; and (2) for plaintiff to sustain his claim he had to show that the mining operation was done in wanton and malicious disregard of his surface rights. The court disallowed defendant's first point by ruling that the deed which used the terms 'mineral' and 'all salt mineral waters' was not broad enough to include subterranean waters. As to defendant's second contention, the court reasoned that where at least two-thirds of the coal was left unmined, where there were no breaks in the mine roof or water leaks under the well, and where there were no cracks or cave-ins on the surface, the mineral owner was not liable for the drying up of the water well. The lower court was thus reversed because of the lack of proof showing any grossly negligent or wanton and malicious actions by defendant. (Logan-Fla)
W69-09068

COMMONWEALTH V GORHAM (SUIT TO COMPEL LAND OWNER TO REINSTATE DRAINAGE SYSTEM).
For primary bibliographic entry see Field 04A.
W69-09069

STIGALL V SHARKEY COUNTY (SUIT TO DETERMINE JURISDICTION OVER HIGHWAY WHICH HAD CAUSED FLOODING).
For primary bibliographic entry see Field 04C.
W69-09070

KIDDE MANUFACTURING CO V TOWN OF BLOOMFIELD (DAMAGES RESULTING FROM STREAM IMPROVEMENTS).
20 NJ 52, 118 A 2d 535-543 (1955).

Descriptors: *New Jersey, *Stream erosion, *Flow augmentation, *Channel improvement, Banks, Bank erosion, Channel erosion, Streambeds, Cities, Stream stabilization, Natural flow, Downstream, Retaining walls, Flood control, Damages, Riparian land, Velocity, Streamflow, Judicial decisions, Construction.

Plaintiff brought this suit to recover damages caused to his property by the acceleration of the flow of water in a certain stream. Plaintiff was riparian land owner on this stream which flowed between the two defendant municipalities. As part of a flood control program defendants constructed concrete walls on the banks and concrete floor on the bed of the stream above and below plaintiff's property. This construction did not include that segment of the stream flowing through plaintiff's property. As a result of erosion of silt and gravel, a wall on plaintiff's land collapsed and a building was damaged. Plaintiff alleged the increase in stream velocity resulting from the improvements caused the erosion and resulting damages. Defendants contended that the erosion was caused by plaintiff's removal of a dam and other stabilizing elements in the stream. From a judgment for defendants, plaintiff appealed. The court held that if the cities knew or should have known that the improvements would so increase the velocity of flow as to cause erosion and damage, and took no steps to avoid that result, they would be liable for the damages. The evidence, however, supported a finding that the cities had exercised reasonable care to avoid damage to plaintiff and that the injuries complained of were the result of plaintiff's own action. (Helwig-Fla)
W69-09071

CHANGING LAW FOR THE CHANGING SEAS,
Columbia Univ., New York.
Louis Henkin.
Uses of the Seas, p 69-97, (E Gullion ed 1968) 29 p, 1 fig.

Descriptors: *Law of the sea, *Oceans, *International law, *International waters, Commercial fishing, Foreign trade, Treaties, Legal aspects, Federal government, Admiralty, Navigation, Military aspects, Water law, United Nations, Continental shelf, Mining, Coasts, Boundaries (Surfaces), Exploitation, International hydrological decade.
Identifiers: *Contiguous zones, *Territorial sea.

Expanded use of the sea and its resources necessitate more enlightened thinking regarding the law of the sea and legal arrangements concerning it. The basic principle of the law of the sea is freedom. This principle and its limitations apply to the sea, the air, and the ocean floor. Coastal states have historical rights in their territorial sea, fishing zones, contiguous zones and continental shelf. Conflicting uses of the sea have forced the development of preferred and reasonable uses of the ocean area as well as international agreements. Issues and problems result from the uncertainties and inadequacies in the law. For example, the continental

shelf, as defined by international convention, is outdated by modern technology. Alternatives have been suggested. Proposals have been made for a new law of the sea as it should apply to military use, scientific research, fishing and mineral resources mining. Advantages may be found in United Nations' control of the sea and in an international authority to govern the seas. (Helwig-Fla)
W69-09072

LAND AND WATER CONSERVATION FUND ACT AMENDMENTS.

Hearing on HR8578 and related bills before the subcomm on National Parks and Recreation of the House Comm on Interior and Insular Affairs, 90th Cong, 2d sess, ser 90-20 (1968).

Descriptors: *United States, *Legislation, *Recreation facilities, *Water conservation, Leases, Federal governments, State governments, Local governments, Recreation, Water resources development, Real property, Resource development, Contracts, Parks, Financing, Land management.
Identifiers: *Land and Water Conservation Fund Act.

The Subcommittee on National Parks and Recreation of the Committee on Interior and Insular Affairs of the House of Representatives met to consider a bill to amend title I of the Land and Water Conservation Fund Act of 1965 and other bills to amend the Land and Water Conservation Fund Act of 1965. The bill amending title I would: (1) add for a limited time additional sources of revenue to the Fund for Federal and state property acquisition; (2) authorize the head of the department concerned to contract, under certain restrictions, for the acquisition of property in advance of the actual appropriation of funds; and (3) authorize a lease-back and sell-back land management program for property acquired by the National Park system with moneys so received being credited to the Fund. The other bills would provide only for increased revenues to the Fund in order to assist federal, state, and local governments in acquiring and developing public outdoor recreation facilities. The committee heard arguments from both sides on the passage of the bill and considered numerous statistics and letters from interested parties. (Heckerling-Fla)
W69-09073

DEPARTMENT OF CONSERVATION.

Minn Stat, secs 84.024 to 84.032, 84.081 to 84.111, 84.14 to 84.154 (1967), as amended, (Supp 1969).

Descriptors: *Minnesota, *Administrative agencies, *Conservation, *Project planning, Legislation, Obstruction to flow, Administration, Legal aspects, Low water mark, Water law, State governments, Boat launching ramps, Boats, Recreation facilities, Boating regulations, Fish conservation, Aquatic plants, United States, Public rights, Land tenure, Financing, Access routes, Projects.
Identifiers: *Injunctions (Prohibitory).

The creation and organization of a department of conservation is provided in this chapter. The commissioner of conservation is vested with prescribed powers and duties with respect to public lands, timber, water and minerals of the state, and records pertaining thereto. Specific responsibilities include boat safety, game and fish conservation, and recreational land project planning, including regulation of public access and boat launching facilities. The commissioner may sue to enjoin an obstruction to waterflow outside the state which affects the state. In civil actions involving navigability or ownership of beds to which the state is a party, the commissioner may stipulate the low water mark involved. The department shall have a division of waters, soils and minerals. The commissioner shall be responsible for state water projects and the sale or acquisition of land for such purposes. A Lac qui Parle and Big Stone Lake Water Control Projects Fund is hereby established. (Harris-Fla)
W69-09074

BRIDGES.

Minn Stat, secs 165.01 to 165.12 (1960).

Descriptors: *Minnesota, *Bridge construction, *Bridge design, *Interstate rivers, Navigable waters, Legislation, Interstate compacts, Disasters, Floods, Bridges, Mississippi River, Federal jurisdiction, Financing, Legal aspects, Local governments, Interstate, Maintenance, Operation and maintenance, Highways, Administrative agencies.
Identifiers: *Toll bridges, *Bridge specifications, Minnesota River, *Draw bridges.

Road authorities may construct and maintain bridges as necessary. All bridges shall be of minimum specified strength and of specified width if constructed subsequent to this act. Bridges of less than minimum width may be repaired or constructed under certain circumstances. The width and grade of approaches to bridges shall be as specified unless modified by the commissioner. To connect highway systems of adjoining states with this state, the road authority may acquire interstate bridges belonging to other states or private persons, and cooperate with other states in construction and maintenance of bridges. Where Congress has authorized bridges over waters between this state and an adjoining nation, the commissioner may cooperate with foreign authorities for bridge construction and maintenance of free or toll bridges. Tolls shall be collected as provided. Local governmental units may acquire bridges over navigable streams if they are 'interested' as prescribed by this act. Bridges over navigable waters or the Minnesota or Mississippi River shall be subject to special approval. All draws shall be opened on reasonable signal. Town bridges destroyed by flood or calamity shall be reconstructed as provided, and financed according to the act. (Harris-Fla)
W69-09075

ROADS, GENERAL PROVISIONS.

Minn Stat Ann secs 160.06, 160.19, 160.20, 160.201 (1960), as amended (Supp 1968).

Descriptors: *Minnesota, *Highways, *Roads, *Drainage, Embankments, Road banks, Transportation, Road construction, Right-of-way, Drains, Ditches, Railroads, Legislation, State governments, Construction, Permits, Legal aspects, Maintenance.

Any forest trail or portage between navigable waterbodies or from navigable waterbodies to a public highway which has been in continuous use for 15 years or more as a trail shall be deemed to have been dedicated to the public. When a road authority constructs a drainage ditch to drain a highway and the ditch crosses a railroad right-of-way, the railroad shall carry the ditch across the right-of-way. The costs shall be apportioned on the basis of benefits to each. The owner of land which drains naturally to a highway may enter the highway to connect his drain to any drain constructed along or across the highway provided he obtains a written permit from the road authority. Anyone desiring to install a drain for agricultural purposes in a natural drain on a highway being constructed, must do so while the highway is being constructed. For the purpose of draining public roads and preventing large accumulations of water in road ditches, the authorities having supervision over the roads may have the ditches cleaned or improved in order to provide proper drainage. (Helwig-Fla)
W69-09076

SUPERVISION OF DAMS AND RESERVOIRS.
Conn Gen Stat Ann secs 25-110 to 25-119 (1960), as amended, (Supp 1969).

Descriptors: *Connecticut, *Supervisory control (Power), *Dams, *Reservoirs, Legislation, Dam construction, Design, Water law, Legal aspects, Inspection, Permits, Administration, Safety, Administrative agencies, Control, Regulation.
Identifiers: Penalties.

The Water Resources Commission in its jurisdiction over all dams, has the power to formulate rules, delegate authority, enter private property and to consult experts necessary to carry out the provisions of this chapter. The commission inspects dams which they deem unsafe and, if found to be unsafe, they may require owners to either make them safe or to remove them. The owners may then be required to make periodic inspections. The commission must issue a permit for any dam to be constructed. All dams, while under construction shall be inspected by the commission to determine whether they will be safe and secure. If this inspection is passed, the commission shall issue a certificate of approval to the dam owner. No order approval or advice by the commission shall act to relieve any dam owner from liability resulting from ownership or operation. Violation of any provision of this chapter or order of the commission is punishable by a fine of $500 a day. Any person aggrieved by a decision of the commission is entitled to a hearing before the commission and an appeal to the superior court. (Holt-Fla)
W69-09077

ALL HE WANTS TO DO IS SAVE THE WORLD
For primary bibliographic entry see Field 05G.
W69-09078

FISH AND FISHERIES.

Md Ann Code art 66C secs 234 thru 237, 245 thru 248, 250, 251, 252A, 253 (1957).

Descriptors: *Maryland, *Tidal waters, *Wildlife, *Fisheries, Anadromous fish, Commercial fish, Herrings, Fish barriers, Fish food organisms, Fish hatcheries, Fish migration, Fish passages, Fish stocking, Dams, Nets, Fish handling facilities, Administrative agencies, Boats, Streams, Riparian rights, Recreation, Explosives, Natural resources, Creeks, Legislation, Regulation, Civil law, Fish conservation.
Identifiers: Chesapeake Bay.

All laws respecting the regulation of size and sale of fish shall apply to those caught in the waters of the state or those caught outside the state and brought into it. The Tidewater and Inland Fishing Commissions shall inspect the waters of the state and may erect and maintain hatcheries where suitable. It is unlawful to place obstructions at the mouth of any stream or cove which would prevent the fish therein from having free passage. All dams must contain at least one fish ladder suitable for allowing fish to have a free course up and down at all times. It shall be unlawful to use dynamite in any stream except for bona fide engineering, milling, or mining purposes. It shall be unlawful to thresh streams for the purpose of driving fish into nets. No boat shall be anchored in any fishery during the herring season. Any boat sailing through a net lawfully placed in the waters shall be guilty of a misdemeanor and liable for the damages it causes. Riparian owners have first rights to conduct a commercial fishery in the waters in front of their property. (Shevin-Fla)
W69-09079

ATLANTIC STATES MARINE FISHERIES COMPACT.

Md Ann Code art 66C secs 256 thru 261 (1957).

Descriptors: *Maryland, *Interstate compacts, *Marine fisheries, *Atlantic Ocean, Shellfish, Anadromous fish, Marine fish, Commercial fishing, Sport fishing, Regulation, Legislation, Administrative agencies, Fish conservation, Fisheries, Fishing, Fish management, Interstate commissions, Governors.

ne provisions of the Atlantic State Marine Fishe-
es Compact are set out. The purpose of the com-
act is to promote better use of Atlantic seaboard
sheries through development of a joint program.
he compact will become effective whenever two
the listed Atlantic states have executed it. Each
gnatory state is to appoint three representatives to
interstate commission which shall ascertain
ethods to conserve marine, shell anadromous
sheries. The commission shall draft and recom-
end legislation to the various states, advise ad-
inistrative agencies as to problems of fisheries
d recommend stocking programs. The federal
sh and wildlife service of the department of the in-
rior shall act as research agency for the commis-
on. An advisory committee of commercial fisher-
en and salt-water anglers shall be set up to advise
e commission. Each member state agrees to con-
ibute to the support of the commission in propor-
on to the value of its fisheries' products. Each
ate initially agrees to contribute an amount based
on the catch record of 1938. Subsequent budgets
ill be recommended by a majority of the commis-
on. The governor of Maryland is authorized to ex-
cute the compact on behalf of Maryland. The
laryland commission members are the director of
e Department of Tidewater Fisheries, a legislator
ho is a member of the commission on interstate
operation, and a private citizen appointed by the
overnor. (Shevin-Fla)
69-09080

ONSERVATION OF WOODLAND AREAS.
ld Ann Code art 66C secs 411 1/2 (1957).

escriptors: *Maryland, *Forest management,
Contracts, *Taxation, Assessments, Tax rate, Pay-
ent, Contract administration, Floods, Forest soils,
atural resources, Forests, Erosion, Economics,
and tenure, Conservation, Recreation, Value,
roperty values, Legal aspects, Legislation, Crop
roduction, Productivity, Private rights, State
overnments, Flood control, Administrative agen-
es.

program of forest conservation and management
nder The Department of Forests and Parks is
tablished to encourage development of produc-
ve woodlands, prevent floods and soil waste, in-
ease individual incomes from sale of timber, and
ovide wooded areas for use and enjoyment.
wners of 5 or more contiguous acres may agree
th the Department to place his land within the
ogram. A contract under this section may be as-
gned to a buyer of all or a portion of a tract, and
new assessment shall be required. (Harris-Fla)
69-09081

RAINING PRIME HOOK CREEK; VIOLA-
ION AND PENALTY.
el Code Ann tit 7, sec 766 (1953), as amended,
upp 1966).

escriptors: *Delaware, *Drains, *Landfills,
Dams, Legislation, Muskrats, Agriculture,
istures, Hay, Boats, Tributaries, Obstruction to
w, Streams, Marshes, Legal aspects, Seasonal.
entifiers: *Delaware Bay, Penalties (Civil),
nalties (Criminal).

o person shall open any drain which would permit
aining of Prime Hook Creek into the Delaware
y between October first and March tenth each
ar. Any person at his own expense may, between
ese dates, fill any drains on the creek to hold
ck sufficient water to float small boats used in
e muskrat industry provided written consent is
tained from the owner of lands where the fills are
be made. After March tenth, such fills must be
moved so as to permit the creek to drain freely
to the bay. Any person may at his own expense,
tween March tenth and October first, open
ains in the creek provided written consent is ob-
ned from the owner of the lands where the drain
to opened. The purpose for this last provision is
allow the creation of a large acreage of marsh
ailable for pasturing and cutting hay. Violations
any provision of this section are punishable by
e and/or imprisonment. (Kahle-Fla)
W69-09082

RESTRICTIONS ON BOATING.

NH Rev Stat Ann secs 486:1 thru 486:7 (1968).

Descriptors: *New Hampshire, *Recreation, *Regulation, Water sports, State jurisdiction, Water utilization, Surface waters, Natural resources, Boats, Boating, Legal aspects.

Motor boats shall not be used or operated on Lake Whittemore, Abbot Forest Pond, or Tolman Pond. The use of any houseboat on Squam and Conway Lakes and Silver Lake in Madison is prohibited. A fine for violating this section is provided. The operation of any boat propelled by electric, naptha, gasoline, steam, or other mechanical power on Lucas Pond is prohibited. Special regulations relating to other water bodies are provided. (Moulder-Fla)
W69-09083

SUBAQUEOUS LANDS.
Del Code Ann tit 7, secs 6451-6459, 6461 (Supp 1966).

Descriptors: *Delaware, *Ownership of beds, *Leases, *Easement, Legislation, Administrative agencies, Public rights, State governments, Permits, Investigations, Administrative costs, Governors, Beds, Beaches, Shores, Beds under water, Land tenure, Public lands.
Identifiers: Subaqueous lands, Applications, Water and Air Resources Commission.

The Governor and the Water and Air Resources Commission shall have exclusive jurisdiction to convey fee simple or lesser interests in the public lands of the state which are submerged. Anyone applying for any interest in these lands must file a request with the commission stating the type of lease, permit or grant desired. The commission shall hold a public hearing if the interest requested is in excess of ten years, if a written objection to the application is filed or if the commission feels that a hearing would be in the public interest. The commission shall publish notice of the application and of any public hearing. The commission may appoint an investigative board to investigate any application. The board shall make recommendations to the commission. The commission shall recommend to the Governor the granting or denial of an application. The Governor shall not execute any lease, permit, deed, or other grant unless it conforms to the recommendations of the commission. The Governor may refuse to approve any application at his discretion. Any interest conveyed under this statute shall be subject to any lease previously given on such land by the Shell Fisheries Commission. (Gadd-Fla)
W69-09084

NATURAL RESOURCES CONSERVATION.

Del Code Ann tit 7, sec 6001 (Supp 1966).

Descriptors: *Delaware, *Water policy, *Resource development, *Water resources, Governments, Administrative agencies, Legislation, Legal aspects, State governments, Federal government, Local governments, Water resources development, Conservation, Wildlife conservation, Natural resources, Administration, Multiple-purpose projects, Planning, Water conservation, Water utilization, Regulation, Control, Long-term planning, Programs, Water supply.

The public policy of this state shall be the development, utilization, and control of all water, underwater and air resources for the maximum beneficial use of its people. Such resources are to be developed and controlled by the Water and Air Resources Commission which is charged with carrying out said public policy. Of special concern to the legislature are: (1) assurance of adequate supplies of these resources for domestic, industrial, power, recreational, and other beneficial uses; (2) regulation and development of water resources in general; and (3) protection and conservation of water, underwater and air resources, for public recreation, and for conservation of wildlife and aquatic life. Programs to initiate and conduct research in these areas and to foster cooperation with federal, state, and local governmental agencies are established by this section with the aim of carrying out the above enumerated policies of the state. (Johnson-Fla)
W69-09085

BOARDS OF DITCH COMMISSIONERS; FORMATION OF A TAX DITCH: PROCEDURE.
Del Code Ann tit 7, secs 4106-4143 (1953), as amended, (Supp 1966).

Descriptors: *Delaware, *Administrative agencies, *Drainage programs, *Drainage districts, Legislation, Local governments, Ditches, Adjudication procedure, Decision making, Administrative costs, Cost sharing, Taxes, Assessments, Costs, Flood protection, Compensation, Damages, Right-of-way, Feasibility studies, Cost-benefit analysis, Investigations, Project planning, Legal aspects, Public rights, Watershed management.
Identifiers: Tax ditches.

Any person can petition the superior court, through the County Soil Conservation District, for the establishment of a tax ditch. A tax ditch is a government subdivision organized to construct a drainage system to drain lands or protect them from flooding. The petitioner must use a particular form and deposit a sum for administrative costs of processing the petition. The soil district through investigation and hearings shall determine the feasibility of the proposed tax ditch. If the district determines the tax ditch is feasible then the ditch commissioners of the county concerned shall make determinations as to the construction needed, the boundaries of the watershed, the permanent rights-of-way needed, the damages to private property, the compensation for improvements already constructed, and the estimated cost of all work to be done. The resident associate judge of the county shall appoint the ditch commissioners and they may get aid from the state drainage engineer. The commissioners shall also compile an assessment list of all affected landowners for distribution of costs. A public hearing of all affected landowners is to be called by the commissioners to obtain opinions and objections on the commissioners' findings. A report of these findings including the results of a referendum of the property owners shall be sent to the superior court. The court shall hold a final hearing and decide on the tax ditch based upon the benefit to the public, the report of the commissioners and the referendum. (Gadd-Fla)
W69-09086

ATLANTIC STATES MARINE FISHERIES COMPACT.

Del Code Ann tit 7, sec 1501-1505 (1953).

Descriptors: *Delaware, *Interstate compacts, *Fish conservation, *Fish management, Fisheries, Fish stocking, Anadromous fish, Atlantic Ocean, Fish harvest, Fishing, Commercial fishing, Sport fishing, Costs, Administrative agencies, Regulation, Federal government, State governments, Financing, Interstate commissions, Legislation, Legal aspects.
Identifiers: Department of the Interior.

The governor shall execute the Atlantic States Marine Fisheries Compact with any of the Atlantic seaboard states or states contiguous thereto with waters frequented by anadromous fish. The agreement shall have for its purpose the better utilization of fisheries through a joint protection program. Each state shall appoint three representatives, one to be the executive officer of the state agency concerned with fisheries, one a legislator, and one a private citizen, to the Atlantic States Marine Fishe-

ries Commission. The Commission shall have power to: ascertain methods to prevent depletion of fisheries; recommend methods for coordination of police powers; recommend regulations to proper state agencies; and recommend to party states the stocking of waters with fish or fish eggs. The Fish and Wildlife Service of the federal Department of the Interior shall act as the primary research agency for the Commission. A committee of commercial and sport fishermen shall be appointed to advise the Commission in its recommendations. Each state shall make appropriation to the Commission in proportion to the market value of its fishery products as well as an initial stated contribution. Pursuant to the compact the three members of the Commission from Delaware are appointed. (Kahle-Fla)
W69-09087

CONSERVATION--FISHING IN CERTAIN WATERS.

Del Code Ann tit 7, sec 1101-1124 (1953), as amended, (Supp 1968), secs 1125-1130 (Supp 1968).

Descriptors: *Delaware, *Freshwater fish, *Sport fishing, *Fish management, Fish conservation, Legislation, Regulation, Fishing gear, Pollution, Fish stocking, Nets, Bass, Carp, Pikes, Walleye, Eels, Herrings, Permits, Water pollution control, Seasonal.
Identifiers: Shad, Penalties (Civil), Limits.

Game and certain other fish are protected by regulations set out in this chapter. Various open seasons are provided, with a closed season on herring after June. Minimum legal sizes are set out, and daily limits allow a catch of 6 for most varieties. Game fish may only be taken by hook and line under immediate observation of the fisherman. Nets and other devices are generally prohibited in freshwater, except for minnow nets and dip nets. Nongame fish may be taken by net with a permit. Nets may be used in tidal waters with some exceptions. No season is provided for carp, and they may be taken with nets in meadows and ditches. Net fishing is prohibited on Sunday and shad fishing on Saturday and Sunday. Specific regulations provide for particular fish, bodies, devices, and non-residents. Pollution is prohibited that causes damage to fish life. Penalties for violation of these regulations are provided. Provisions are made for a freshwater trout stamp, the proceeds from which are used for restocking trout. (Douberley-Fla)
W69-09088

HEALTH AND SAFETY (ADMINISTRATIVE AUTHORITY FORMATION).
For primary bibliographic entry see Field 05G.
W69-09089

INVESTIGATION OF HIGH AND LOW LEVELS.
For primary bibliographic entry see Field 04A.
W69-09090

ROSE V STATE (APPROPRIATION OF RIPARIAN RIGHTS).

24 NY 2d 81, 298 NYS 2d 968-978 (1969).

Descriptors: *New York, *Riparian rights, *Alteration of flow, Riverbeds, Competing uses, Diversion, Industrial water, Obstruction to flow, Water loss, Judicial decisions, Legal aspects, Appropriation, State government, Compensation, Damages, Factories, Water utilization.
Identifiers: *Chenango River, Chenango, Broome County.

Plaintiff owned two corporations engaged in processing and selling gravel, sand, stone, and concrete from plants located on property abutting the Chenango River. The water source was necessary due to the quantity of water required in the manufacturing process. The state of New York changed the riverbed from the area in which the corporation maintained their water intake line. The corporation was forced to relocate its plants. Plaintiff sued for compensation for the destruction of the corporate riparian rights. The court held that where the state takes property, the owner must be indemnified, insofar as possible, and the owner was entitled to compensation for injuries to the business' assets. The state was liable for moving fees or the difference between salvage and reproduction cost less depreciation, which ever amount was smaller. (Moulder-Fla)
W69-09091

CONDEMNATION OF LANDS OR RIGHTS-OF-WAY: WRITTEN NOTICE TO LANDOWNER.

SC Code Ann sec 58-771 (1962).

Descriptors: *South Carolina, *Condemnation, *Railroads, Canals, Right-of-way, Compensation, Legislation, Legal aspects, Public rights, Eminent domain, Land tenure, Land use, Construction, Appropriation.
Identifiers: Legal notice.

Whenever any person shall be authorized by charter to construct a railway or canal in South Carolina, and it is to be constructed across private lands, such person shall give proper notice to the landowners involved that a right-of-way is required for construction. Such notice must be given 30 days before entering upon any lands to begin construction, and shall be served upon such owner in the same manner as required by law for the service of a summons in civil actions. (Carruthers-Fla)
W69-09092

PAY STATE LOBSTER CO., INC. V PERINI CORP. (DAMAGE CAUSED BY DREDGING).

245 NE 2d 759-760 (Mass 1969).

Descriptors: *Massachusetts, *Dredging, *Lobsters, *Permits, Judicial decisions, Contracts, Silts, Water pollution effects, Water circulation, Intake structure, Commercial fishing, Water pollution sources, Commercial shellfish, Damages.
Identifiers: United States Coast Guard, Negligence.

Plaintiff sued for damages caused by defendant's dredging of Boston Harbor which raised silt and killed plaintiff's lobsters. Defendant had been warned but continued dredging. The attachment of extension pipelines to the lobster tanks' intakes would have alleviated the problem. Defendant had the technical competence to install the pipes and it would have been inexpensive in relation to what defendant would receive for the dredging. Defendant only attempted to install one pipeline after ten days of dredging. Plaintiff did not have the technical competence to install the pipelines and could not have had t hem installed for three or four months. These facts warranted a finding of negligence against the defendant. Defendant was not relieved of his negligence by his contract for the dredging with the United States Coast Guard nor by his license from the Department of Public Works. (Gadd-Fla)
W69-09093

FERRIES.

Ill Ann Stat ch 55, secs 20.21 (Smith-Hurd 1967).

Descriptors: *Illinois, *Transportation, *Boats, Ohio River, Land tenure, Boating, Watercourses (Legal), Lakes, Rivers, Legislation, Legal aspects, Permits, Streams, Public rights, Reasonable use, Compensation, Public benefits, Repairing.
Identifiers: *Ferries, Penalties (Civil), Fines.

All ferries established over the Ohio River, or over any waterway within this state, which have been kept in operation and repair and have not b discontinued or abandoned since their establ ment, shall be declared established ferries wi the meaning of this act and entitled to the bene of the same. The penalty for operating any boa other craft as a ferry without a license and with miles of any established ferry, shall be forfeitur such boat or craft to the ferry owner and a fin $15 for each person who was thus unlawfully c veyed to be paid to the ferry owner. Nothing he shall be construed to prevent private, noncomm cial use of one's own boat or craft to cross stream or watercourse or to cross himself and neighbors when done without fee and when established ferry is not in actual operation or in ficient repair to afford a safe and speedy passag persons and property. (Carruthers-Fla)
W69-09094

PUBLIC SERVICE COMPANIES.
For primary bibliographic entry see Field 04A.
W69-09095

KEATOR V STATE (CONDEMNATION RIPARIAN PROPERTY).

23 NY 2d 337, 244 NE 2d 248-250 (1968).

Descriptors: *New York, *Condemnation va *Riparian land, *Recreation facilities, Condem tion, Damages, Adjudication procedure, Land Riparian rights, Delaware River, State gove ments, Land appraisal, Construction co Depreciation, Compensation, Property valu Legal aspects, Judicial decisions, Value.

Plaintiff's property, located on the Delaware used as a clubhouse and meeting place, was c demned by the state. Plaintiff was awar $15,900. The first appellate court reduced award to $12,000 holding that the trial court inc rectly added building reproduction costs to l value without any suggestion that the property either unique or a specialty. This court, on app by the plaintiff, reinstated the trial court's awa Just compensation should normally be determi by fair market value, but fair market value, in t must be based upon the highest and best use of property. Since the evidence showed that the use of this property was as a clubhouse, it could termed a 'specialty' and as such was not suscepti to the rule of fair market value. An award based the current cost of reproduction less depreciat was proper. (Kahle-Fla)
W69-09096

NAVIGABLE WATERS FREE.
SC Const art 1, sec 28 (1962).

Descriptors: *South Carolina, *Navigable wat *Public rights, *Water policy, Navigation, Wa law, Legislation, Legal aspects, Political aspe Jurisdiction, Navigable rivers, Water rights, Rip an rights, Riparian waters, Transportation, Tax Shores, Usufructuary right.
Identifiers: Constitutional provisions.

All navigable waters are public highways free to citizens of the state and the United States with tax, impost or toll imposed. Similarly no tax, impost or wharfage may be imposed upon owners of any merchandise or commodity for use of the shores or any wharf erected on the sho or in or over the waters of any navigable stream less the same be authorized by the general sembly. (Johnson-Fla)
W69-09097

EMINENT DOMAIN.

SC Const art 14, sec 1 (1962).

Descriptors: *South Carolina, *Boundaries (P perty), *Navigation, *Navigable waters, Emin domain, Water policy, Water law, Legislati

itical aspects, Legal aspects, Jurisdiction, State ernments, Public rights, Taxes, Navigable rs, Water rights, State jurisdiction.

e state has concurrent jurisdiction on all rivers dering on it so far as such rivers form a common ndary. Such rivers, together with all navigable ers within the state, are common highways and ll be forever free not only to inhabitants of the e but also to all citizens of the United States, hout any tax or impost therefore, unless the ie be expressly provided for by the general as- bly. (Johnson-Fla)
9-09098

LL DRILLERS.
Ann Code art 96A:80-88 (Supp 1968).

scriptors: *Maryland, *Wells, *Well regulat ions, rilling, Administrative agencies, Well permits, mits, Water permits, Water wells, Legislation, gging, Water conservation, Dri ll holes, Excava- ns, Pipes, Casings, Subsurface investigations, al aspects, Regulation, Control.
ntifiers: *Licenses.

s statute creates the Maryland State Board of ll Drillers. The board is authorized to grant nses to anyone intending to engage in well ling. No one shall practice the business of well ling unless he has a license. The board may oke or suspend a license for: (1) fraud or decei t btaining a license; or (2) gross negligence, in- mpetence or misconduct in the well drilling busi- s. There shall be a hearing by the board upon charge leading to revocation or suspension. y accused licensee shall have the right to appear person and by counsel to cross-examine wit- sses and present his own witnesses. Anyone ag- eved by a final decision of the board shall have right to judicial review. The board may enter reciprocity agreements with the licensing ncies of other states. Any person engaging in well drilling business without a license shall be ject to a fine. (Helwig-Fla)
9-09099

ARK'S HILL AUTHORITY.

Code Ann, secs 59-91 thru 59-93 (1962).

scriptors: *South Carolina, *State governments, ederal Government, *Project planning, Projects, ject purposes, Public benefits, Streams, Canals, tercourses, Interstate rivers, Interstate com- cts, Administrative agencies, Legislation, Legal ects, United States, Georgia.
ntifiers: Savannah River, Clark's Hill Project.

ere is hereby established Clark's Hill Authority South Carolina. It shall consist of and be erned by an 11 member board appointed by the ernor. The Authority may: (1) inquire into the ns for development of the Clark's Hill Project by United States Government, by Georgia or by other agency; (2) encourage, promote and perate in the development of the Clark's Hill ject and of the Savannah River and any water- rses flowing into same; (3) negotiate agree- nts, accords or compacts in the name of the te with Georgi a, the United States or any other te or agency relating to the development of the rk's Hill Project, the development of the Savan- River and waterways flowing into said river. y agreement, accord or compact made by the thority shall be subject to approval by concur- t resolution of the general assembly. (Car- hers-Fla)
9-09100

QUISITION OF LANDS AND CONDEMNA- ON THEREOF.

Code Ann secs 59-221, 59-222, 59-224 (1962).

Descriptors: *South Carolina, *Condemnation, *Cities, *Water supply, Right-of-way, Legislation, Streets, Public health, Dams, Canals, Lakes, Pollution abatement, Drainage, Drainage systems, Compensation, Land tenure, Streams, Operation and maintenance, Municipal water, Watershed management, Surface runoff, Surface drainage, Drains, Surface waters, Legal aspects, Local governments.

Cities and towns may purchase and hold suitable lands and water and erect aqueducts, dams, canals, and other such works as may be necessary to obtain and secure a supply of water. The city shall have the right to condemn: (a) any lands, the drainage from which would contaminate the water supply of the city; (b) such streams and lakes as may be required for the water supply; and (c) rights-of-way in order to operate aqueducts, dams, and canals. Just compensation shall be paid as provided for by law. Any municipal corporation desiring to establish or extend waterworks may condemn water rights and water privileges. Such corporation may also condemn lands for the purpose of protecting watersheds from contamination, nuisances, or any condition menacing to public health. Proper compensation shall be made. If surface water is carried off from any street or public thoroughfare, such municipality shall provide sufficient drainage for the surface water through open or covered drains in such manner as to prevent passage of the wat er over private lands. However, if such drains cannot be had along such thoroughfares, the municipality may obtain a right-of-way through the private lands for the necessary drains. (Heckerling-Fla)
W69-09101

WATERSHED CONSERVATION DISTRICTS.
For primary bibliographic entry see Field 04D.
W69-09102

ARKANSAS POWER AND LIGHT CO. V CASH (OPERATION OF DAMS IN FLOODS).
For primary bibliographic entry see Field 04A.
W69-09103

MICHIGAN STATE HIGHWAY COMM'N. V MCLAUGHLIN (CONDEMNATION VALUES AND SPECULATIVE BENEFITS).
167 NW 2d 468-470 (Ct App Mich 1969).

Descriptors: *Michigan, *Condemnation, *Condemnation value, *Damages, Benefits, Eminent domain, Ponds, Right-of-way, Borrow pits, Remedies, Legal aspects, Judicial decisions, Administrative agencies, Property values, Real property.

Plaintiff Michigan State Highway Commission instituted proceedings to effect the condemnation of a portion of defendants' land for the construction of part of an interstate highway. Plaintiff also asked for the right to construct a temporary road on defendants' property and the right to remove sand, gravel, and earth for highway construction purposes. Plaintiffs claimed defendants should not receive any compensation because the benefits to defendants' property exceeded the damage. The claimed benefits accrued when the excavation left a pond which plaintiffs argued could be developed into a resort, though admittedly only at considerable expense. When the trial court instructed the Commission to calculate the value of the borrow by using either units of cubic yards or acres and to take into consideration any benefits accruing to the land in determining damages, defendant appealed. The court remanded because of improper instructions to the Commission. To promote consistency in determining the value of a borrow, the valuation must be based on the actual number of cubic yards taken. Furthermore, it is improper in weighing damages to take into account those speculative benefits which could only be obtained by expensive alterations on preparations. (Gabrielson-Fla)
W69-09104

EDWARD V MASSETT (IMPROVEMENT OF STREAM AS DRAINAGE OUTLET).
For primary bibliographic entry see Field 04A.
W69-09106

GENERAL PROVISIONS AS TO FISH AND GAME.
NH Rev Stat Ann secs 207:1, 207:2, 207:5, 207:8-207:10, 207:14-207:21, 207:31, 207:36, 207:40-207:44, 207:46, 207:47 (1964).

Descriptors: *New Hampshire, *Wildlife management, *Fish conservation, *Fish management, Legislation, Water law, Water policy, Legal aspects, Control, Regulation, Permits, Conservation, Fish, Fish establishment, Fish harvest, Administration, Fishing, Water utilization, Water sports, Hunting.
Identifiers: Possession limits.

Fishing, unless otherwise permitted, may be done only by angling. Certain devices are absolutely prohibited. These include snatch hooks, spears and grapling hooks. No living fish or fry may be imported into the state or released into the state's waters without a proper permit. Possession of fish out of season is prima facie evidence of unlawful taking by the possessor and all fish illegally taken must be seized by conservation officers. Transportation of up to two days limit on fish is authorized by this chapter with the special limitation that fish shipped by common carrier must be properly marked as set out in this section. When there is a danger of starting fires, the governor and council may, upon joint recommendation, declare any or all woodlands closed to hunters, fishermen, and trappers. Upon a proper hearing certain waters may be closed to public use to protect a crop of ice while it is being formed, cut and harvested. Foreign hunt clubs must be incorporated in the state before they may acquire any property in the state. (Johnson-Fla)
W69-09107

METHOD AND MANNER OF TAKING FISH.
For primary bibliographic entry see Field 08I.
W69-09108

LOBSTERS AND CRABS.

NH Rev Stat Ann secs 211:18-211:45 (1964), as amended, (Supp 1967).

Descriptors: *New Hampshire, *Lobsters, *Crabs, *Regulation, Control, Shellfish, Inspection, Legal aspects, Legislation, Water policy, Permits, Commercial shellfish, Crustaceans, Commercial fishing, Conservation, Fish conservation, Trapping.
Identifiers: Licenses.

To take crabs and lobsters within the state one must procure a special license, and before receiving such license one must show proof that he has resided within the state for at least five years immediately preceding his application. The five-year resident requirement may be waived in case of a resident who does not at any time use more than five lobster traps. Female lobsters carrying spawn must be marked and immediately returned to the water. Lobsters so marked must be returned to the water if taken again. It is illegal to possess, sell, or transport lobsters if less than 3 1/8 inches in length. Lobster and crab traps must be clearly marked with the owner's initials and properly buoyed. A conservation officer may board any vessel, and such vessels' crews may not throw any materials overboard upon noticing his approach; such officer may inspect without a search warrant upon reasonable cause to suspect a violation of this chapter. Both retail and wholesale dealers in crabs and lobsters must obtain a proper license for same. (Johnson-Fla)
W69-09109

PUBLIC FOREST LANDS.

NH Rev Stat Ann secs 219:7-a, 219:8-a (1964).

Descriptors: *New Hampshire, *Islands, *Recreation facilities, *Parks, Recreation, Public benefits, Ponds, Boating regulations, Regulation, Administrative agencies, Legislation, Lakes, Conservation, Forest management, State governments.
Identifiers: Legal aid.

Listed islands are placed under the jurisdiction of the Department of Resources and Economic Development as public reservations. The Department shall have no authority to sell or dispose of such islands, and title to such islands is not affected. The Department may prescribe rules and regulations for the use of boats on Mill Pond and North Pond in Pillsbury State Park and Spruce Pond and Bear Hill Pond in Bear Brook State Park. (Kahle-Fla)
W69-09110

POWERS TO LAYOUT HIGHWAYS.

NH Rev Stat Ann secs 232:3, 232:6 (1964).

Descriptors: *New Hampshire, *Highways, *Highway construction, *Highway effects, Bridges, Bridge construction, Bodies of water, Streams, Navigable waters, Boats, Navigation, Lumber, Legislation, Regulation, Local governments, Administrative agencies.
Identifiers: Obstruction to navigation.

Highways to public waters, not part of a primary or secondary highway system, may be laid out as class V highways by the city officials of the city in which the highway is located, or may be laid out as provided by a commission appointed by the governor and council. A highway, or an alteration thereof, may be laid out across any body of water unless such bridge or highway may prevent the use of such waters for navigation or for running timber. (Kahle-Fla)
W69-09111

POWERS OF CONSERVATION DISTRICTS AND SUPERVISORS.

NH Rev Stat Ann sec 430-B:9 (1968).

Descriptors: *New Hampshire, *Soil conservation, *Land management, *Flood control, Adoption of practices, Financing, Erosion control, Legislation, Legal aspects, Water law, Administrative agencies, Administration, Natural resources, Soil stabilization, Soil management, Land, Land development, Land reclamation, Sediment control, Flood damage, Projects, State governments, Federal government, Resource development, Planning.
Identifiers: *Conservation districts.

The conservation districts and supervisors thereof have the power to conduct surveys, investigations and research relating to the character of soil erosion, floodwater and sediment damages and land drainage as well as to promote conservation and development of soil, water and related natural resources. Such research may not be initiated by any district except in cooperation with the state or federal government in order to avoid duplication. Demonstration projects and preventive control measures may be carried out by such districts which will furnish certain financial aid therefore. The districts are authorized to acquire real and personal property in this regard and may manage federal property located therein. The districts also may furnish written reports, machinery and fertilizer to land occupiers within their jurisdiction. Each district should develop comprehensive plans for the development and conservation of soil within its bounds. Before receiving benefits from the district, landowners may be required to contribute money, materials or land for the purposes outlined herein. (Johnson-Fla)
W69-09112

NEGLECT OF TOWN TO BUILD HIGHWAYS OR BRIDGES.

Vt Stat Ann tit 19, secs 571-574, 631-636, 640-647 (1968).

Descriptors: *Vermont, *Bridge construction, *Administration, *Local governments, Legislation, Legal aspects, Water law, Bridges, Civil engineering, Jurisdiction, Financing, Planning, Regulation, Political aspects.

When a town fails to build a bridge as mandated by the supreme or county court the original petitioners for same may apply for a fine to be assessed against the town in an amount sufficient to build such a structure. The money thus received is applied to such construction under the direction of a court appointed commissioner provided, that if the bridge is discontinued, the court may order the money to be returned to the town. Either by petition of freeholders or agreement of the selectmen bridges may be constructed between two towns and the expense apportioned as they agree. When selectmen fail to take action on a freeholder petition resort may be had to the county court on application of twenty or more freeholders. The court appoints three disinterested freeholders who hold a hearing to determine the necessity of such a bridge and the appropriate expenses to be borne by each town. A report of their findings must be filed with the court which may order the building of such bridge. (Johnson-Fla)
W69-09113

HIGHWAYS AND BRIDGES.
Vt Stat Ann tit 19, secs 931-933 (1968).

Descriptors: *Vermont, *Administrative agencies, *Local governments, *Maintenance, Highways, Bridges, Jurisdiction, Repairing, Legislation, Legal aspects, Water law, Civil engineering, Operation and maintenance.

Each town is responsible for repair of highways and bridges throughout all seasons of the year if they are not part of the state highway system. Towns must cause covered bridges or highways to be appropriately lighted. If a town has no agents for these purposes or if such agents refuse or neglect to perform these duties, the selectmen in each town are charged with the responsibility of seeing that these functions are performed. (Johnson-Fla)
W69-09115

FLOODS, STREAMS, AND DRAINAGE.
For primary bibliographic entry see Field 04A.
W69-09116

MILLS, DAMS OR BRIDGES.
Vt Stat Ann tit 13, sec 3733 (1958).

Descriptors: *Vermont, *Damages, *Dams, *Bridges, Mills, Reservoirs, Gates, Flumes, Legislation, Engineering structures, Legal aspects.
Identifiers: Penalties (Criminal), Water mill, Toll bridge.

Any person who willfully and maliciously injures, removes or opens a dam, reservoir, gate, or flume or injures or removes the wheels, mill gear, or machinery of a water mill, or injures, removes or destroys a public toll bridge shall be either imprisoned or fined. (Shevin-Fla)
W69-09118

ILLINOIS AND DESPLAINES RIVERS.
For primary bibliographic entry see Field 04A.
W69-09119

TRI-CITY PORT DISTRICT.

Ill Ann Stat ch 19, secs 285, 287, 297 (Smith-Hurd 1963), as amended, (Supp 1969).

Descriptors: *Illinois, *Port authorities, *Harb
*Navigable waters, Permits, Piers, Docks, Str
tures, Bridges, Boundaries (Property), State
risdiction, Bodies of water, Legislation, Admi
trative agencies, Regulation, Boating regulatio
Planning, Landfills, Construction, Obstruction
flow, Boats, Ships, Bridge construction, Landf
Legal aspects.
Identifiers: Obstruction of navigation.

The Tri-city Regional Port District has power
issue permits for the erection of any struct
within 40 feet of any navigable waters within
Port District and for the deposit of any fill in
waters. No such permit is necessary for the erect
by a city of a bridge crossing a waterway wh
serves as a boundary between Illinois and anot
state. Applications for permits shall include pl
and specifications and such other information
may be required by the Port District. No such p
mit is required if a permit was acquired from
proper agency prior to the creation of the Port D
trict and in the case of projects by certain cities
agencies. Structures erected without permits m
be removed at the expense of the responsible pa
or, if it is decided by the Port District that s
structure or deposit may remain, the Port Dist
may regulate its use. The district may remove
structions from navigable waters, establish do
shore and harbor lines, and regulate anchora
speed of vessels, and operation of bridges wit
the district. 'Navigable waters' are defined as '
public waters which are or can be made usable
water commerce.' (Kahle-Fla)
W69-09120

**KASKASKIA REGIONAL PORT DISTRI
ACT.**

Ill Ann Stat ch 19, secs 502, 507, 530 (Smith-H
Supp 1969).

Descriptors: *Illinois, *Navigable waters, *Navi
tion, *Regulation, Structures, Bridges, Bre
waters, Bulkheads, Weirs, Piers, Jetties, Roc
Sands, Obstruction to flow, Docks, Harbors, Boa
Boating regulations, Administration, Administ
tive agencies, Legislation, Legal aspects, Wa
law, Transportation, Construction, Permits, La
fills, Rock fills, Cities, Shores.
Identifiers: *Port district, Penalties (Crimina
Public waters.

'Navigable waters' means any public waters wh
are or can be made usable for water commer
The Kaskaskia Regional Port District has the
lowing rights and powers: (a) issue permits for
construction of all structures of any kind, ov
under, in or within 40 feet of any navigable wa
within the port district and for the deposit of
materials of any kind in such waters; (b) prev
and remove obstructions, including the removal
wrecks; (c) locate and establish dock lin
anchorage and shore or harbor lines; and (d) re
late the anchorage, moorage and speed of vess
and establish and enforce regulations regard
bridge operation beyond the jurisdiction of any m
nicipality. It is unlawful to deposit fill or refuse
any kind or build any structure within 40 feet
any navigable water within the port district with
first receiving a permit therefore from the port
trict. Violators of this requirement shall, upon c
viction, be fined, imprisoned or both. Any str
ture, fill or deposit erected or made in violation
this section is declared to be purpresture and m
be abated. If the port district decides that su
structure, fill or deposit may remain, the port
trict may make any rules, regulations, changes, a
repairs it deems necessary to protect the interest
the port district. (Carruthers-Fla)
W69-09122

PURE WATERS BOARD.
For primary bibliographic entry see Field 05G.
W69-09123

WATERWORKS AND FILTRATION PLANTS.

Ill Ann Stat ch 105, sec 327X (Smith-Hurd 1952).

Descriptors: *Illinois, *Waterworks, *Land use, *Construction, Legislation, Buildings, Land management, Riparian rights, Ownership of beds, Riparian land, Beds under water, Cities, Water purification, Land, Tunnel construction, Intakes, Breakwaters, Legal aspects, Real property.
Identifiers: *Public waters, Submerged lands.

Any park commission which has acquired the title to land adjacent to or adjoining any public waters, to the submerged lands and beds of such public waters or to any riparian rights in relation to such waters may grant any of these lands or rights to any city which has a population of 500,000 or more and which operates its waterworks system. The conveyed land or rights may be used as a site for buildings and other structures for improving the waterworks system and for the construction of water purification plants, intakes, tunnels, breakwaters and other structures connected with the waterworks system. (Shevin-Fla)
W69-09124

RIVER CONSERVANCY DISTRICTS.
For primary bibliographic entry see Field 05G.
W69-09125

RIVER CONSERVANCY DISTRICTS.
For primary bibliographic entry see Field 05G.
W69-09126

RIVER CONSERVANCY DISTRICTS.
For primary bibliographic entry see Field 05G.
W69-09127

RIVER CONSERVANCY DISTRICTS.
For primary bibliographic entry see Field 05G.
W69-09128

JURISDICTION OVER LAKE MICHIGAN; JURISDICTION OVER RIVERS.

Ill Ann St at ch 34, secs 2, 3 (Smith-Hurd 1960).

Descriptors: *Illinois, *Jurisdiction, *Boundaries (Surfaces), *Rivers, Legislation, Local governments, Lake Michigan, Mississippi River, Ohio River, Legal aspects.

Each county bounded by either the Mississippi, Ohio or Wabash River shall have jurisdiction over such river to the extent it is so bounded which jurisdiction may be exercised concurrently with the contiguous states bounded by such river. Each of the counties bordering on Lake Michigan shall have jurisdiction over said lake eastwardly, to the east line of the state. (Heckerling-Fla)
W69-09129

ACQUISITION OF PROPERTY NECESSARY TO STRAIGHTEN DITCH.
Ill Ann Stat ch 121, secs 4-502 (Smith-Hurd 1960).

Descriptors: *Illinois, *Ditches, *Eminent domain, Drains, Watercourses (Legal), Administrative agencies, State governments, Drainage engineering, Surface waters, Road construction, Compensation, Repairing, Highways, Legislation, Legal aspects.

When the State Highway Department deems it necessary to build, widen, alter, relocate or straighten any ditch, drain or watercourse in order to drain any highway it is authorized to construct, maintain or operate, it may acquire the necessary property by gift or purchase, or if the compensation or damages cannot be agreed upon, by the exercise of eminent domain. The Department shall not be required to furnish bond in any eminent domain proceeding. (Shevin-Fla)
W69-09130

TOLL BRIDGES.
Ill Ann Stat ch 137, secs 1, 2, 5 (Smith-Hurd 1964).

Descriptors: *Illinois, *Bridges, *Navigable waters, *Land tenure, Legislation, Navigation, Local governments, Bridge construction, Watercourses (Legal), Lakes, Rivers, Legal aspects, Regulation.
Identifiers: *Toll bridges, Obstruction to navigation.

No toll bridge shall be established or erected across any lake, river, creek, or other water course in this state without the consent of the county board of the county in which the bridge is to be established or erected. No bridge shall be constructed over any navigable water without a suitable draw for the passage of watercraft, nor in any manner so as to interfere with navigation. Owners of land along the watercourse over which a toll bridge is proposed to be established shall have the preference in applying for the right to build such bridge. (Heckerling-Fla)
W69-09131

INTRASTATE, INTERSTATE, AND INTERNATIONAL LEGAL AND ADMINISTRATIVE PROBLEMS OF LARGE-SCALE WATER TRANSFER,
Department of the Interior, Washington, D.C. Office of the Solicitor.
Edward Weinberg.
IN W.G. McGinnies and B.J. Goldman, eds., Arid Lands in Perspective, p 352-358, University of Arizona Press, Tucson, 1969. 7 p.

Descriptors: *Interbasin transfers, *Water law, Legal aspects, Southwest U.S., Export, Water transfer, Water conveyance, Water management (Applied), Administrative agencies, Coordination, Water allocation (Policy), Jurisdiction, Negociations, Project planning, Administrative decisions, Water law, Federal-state water rights conflicts, Legislation, Interstate.
Identifiers: Canada, North American Water and Power Alliance, Colorado River Basin Project Act.

Some of the major legal developments in the U.S. concerning large-scale transfers of water between basins are discussed. In particular the Colorado River Basin Project Act of 1968 is considered. One major problem of transfers revolves around the apprehension of the people of the area of origin as to how the project might inhibit what they believe to be their opportunities for long term economic growth. The 10 yr. moratorium on studies of importations into the Colorado River basin allows focus of attention on alternatives. The North American Water and Power Alliance proposal serves as an illustration of the international legal problems developing from large scale water transfer. Several of these are discussed and some questions are posed. The diversity of agencies responsible for the U.S. governments planning, construction, funding and operation of water resources projects is compared to the advantages and disadvantages of one centralized authority. It is concluded that the diversity of interests represented by the many agencies is a good guarantee of development approaching the optimum. (See W69-09210). (Sherbrooke-Ariz)
W69-09216

DELAWARE RIVER BASIN COMPACT.

Del Code Ann tit 7, sec 6501, art 1, 2, 3, 11, 13, 14 (Supp 1966).

Descriptors: *River basin development, *Interstate compacts, *Water utilization, Water resources development, Water allocation (Policy), Water distribution.
Identifiers: *Delaware River Basin, INCODEL.

The Interstate Commission of the Delaware River Basin (INCODEL) replaced numerous federal and state agencies in exercising authority over the basin. The governors of the parties--Delaware, New Jersey, New York, Pennsylvania, and a federal commissioner are members; each member has one vote. The Commission develops and effectuates plans, policies and projects relating to water resources of the basin. A comprehensive plan for immediate and long-range development and uses is supplemented by an annual water resources program to meet estimated needs. All federal, state and local projects are cleared through the Commission and are not approved unless consonant with the comprehensive plan. Waters may be allocated among the signatory parties, and the Commission may impose conditions, obligations and requirements related thereto. Broad powers extend to all projects, research and changes for use of facilities, and include eminent domain. INCODEL has corporate powers with the commissioners acting as governing body and an executive director as administrator. Rules and regulations may be enforced under state penal sanctions and, in the absence of such statute, by a fine of from $50 to $1000. (Douberley-Fla)
W69-09267

DELAWARE RIVER BASIN COMPACT.

Del Code Ann tit 7, sec 6501, art 4-7 (Supp 1966).

Descriptors: *River basin development, *Interstate compacts, *Water utilization, Pollution abatement, Water allocation (Policy), Flood control, Flood plains, Watershed management, Assessments, Cost-benefits analysis.
Identifiers: *Delaware River Basin, INCODEL.

INCODEL has the power to develop water use and to control it by storage and release, without interference from signatories. Stream regulation may be provided, and the user benefitted thereby may be assessed for the improvements. The Commission cannot engage in the business of distributing water. It may investigate water pollution and operate projects to control and abate it. Rules or works may be established to protect public health or to preserve the waters, and orders may be issued to restrain violation, or INCODEL may file complaints with other pollution abatement agencies. The signatories agree to legislate to prevent pollution, and the compact will not inferfere with state jurisdiction. INCODEL may plan, design, and operate projects for flood damage reduction, and set up standards for the use of land which is subject to flooding, notwithstanding inconsistent state regulations. It may establish encroachment lines on flood plains and is empowered to acquire this land to minimize flood hazards and to pose hazard warnings. INCODEL promotes watershed management, but is not to operate a facility if other agencies are available to do so. (Douberley-Fla)
W69-09303

WATERCOURSES--RECREATIONAL USES FOR WATER UNDER PRIOR APPROPRIATION LAW,
Willis H. Ellis.
Natural Resources Journal, Vol 6, No 2, p 181-185, Apr 1966. 5 p, 18 ref.

Descriptors: *Recreation, *Prior appropriation, Judicial decisions, Colorado, Water rights, Market value, Legislation.
Identifiers: *Colorado River Conservation District.

In 1935, the Colorado River Conservation District was legally granted the power to preserve sufficient waters for public recreation. However, when it tried to employ this power in 1965, the Colorado Supreme Court denied the District its water right. This article evaluates the action of the court and the provision for water recreation in Colorado. Western prior appropriation water law allows water rights to be sold apart from land. Ideally, this type of market allocates water to the highest economic uses available in the area. A major blind spot in this system is recreation, which has economic value for the entire area but has no one to bid for it. The District, originally empowered to set some waters

apart from the market, had insufficient guidelines for evaluating recreational uses and for selecting the amount and location of recreational waters. The article concludes that, to achieve a balanced water economy, the Colorado legislature should try again to legislate extra-market protection of some natural resources. This time, however, it should specify the means by which the agency is to choose the amount and location of the water to be withdrawn. (Gossen-Chicago)
W69-09324

DELAWARE RIVER BASIN COMPACT.

Del Code Ann tit 7, sec 6501 (Supp 1966).

Descriptors: *River basin development, *Interstate compacts, *Water utilization, Recreation, Hydroelectric plants, Withdrawal, Water shortage, Facilities, Hydroelectric power.
Identifiers: *Delaware River Basin, INCODEL.

INCODEL shall provide for the development of water related public sports and recreation facilities, but it shall operate such facilities only in the absence of other suitable agencies. It regulates contracts for recreation facility concessions and recommends standards for their operation. Waters may be impounded and facilities may be authorized or operated by the Commission for generation of hydroelectric power. Facilities may be provided for transmission of power, but INCODEL is not authorized to sell such power to consumers. Withdrawals and diversions may be regulated and areas designated as 'protected' or 'emergency' in the event of a water shortage threat. Use may be restricted to permits issued by the Commission. INCODEL sets up cost and reimbursement formulas for the parties and adopts an annual budget with payment schedules. It may also borrow money or issue tax-free bonds up to 6% interest. (Douberley-Fla)
W69-09326

Government roles in basic water research,
Colorada Univ., Boulder.
Gordon L. Allott.
Water Development Utilization, Conservation, 5th Western Resources Conference, Boulder, Colo, p 3-8, 1963.

Descriptors: *Interstate commissions, *Federal-state water rights conflicts, *State jurisdiction, Research and development, Water resources development.

Offered is an alternative to federal dominance in the field of water resources research. The author suggests the use of interstate compacts as bases for research and development. While these compacts have so far largely been concerned with division of the waters in interstate streams, the author contends that the mechanism of an interstate compact can be used for planning and administering comprehensive development of an interstate stream. An interstate river commission is seen as being a more appropriate agency to plan and administer river basin development than an all-federal agency because it maintains the decision-making process within the area where the decision must be made and because each state's water problems is somewhat different from the other state's water problems. (Starr-Chicago)
W69-09329

CERTAIN LOCAL PROVISIONS (FORMATION OF DRAINAGE DISTRICTS).
For primary bibliographic entry see Field 04A.
W69-09348

DRAINAGE DISTRICTS UNDER 1920 ACT.
For primary bibliographic entry see Field 04A.
W69-09361

THE STATE NAVIGATION SERVITUDE,
For primary bibliographic entry see Fiel d 04A.
W69-09377

GRANT OF EMINENT DOMAIN; EXCEPTION AS TO MILLS AND WATER POWERS.
NC Gen Stat sec 62-183 (1965).

Descriptors: *North Carolina, *Eminent domain, *Condemnation, *Public utilities, L egislation, Legal aspects, Compensation, Utilities, Competing uses, Electric power, Reservoirs, Water distribution (Applied), Ponds, Dams, Powerplants, Hydroelectric power, Diversion, Mills, Public benefits.

Certain public utilities are authorized to take such lands by eminent domain proceedings as may be necessary for the establishment of reservoirs, ponds, dams, works, railroads or powerhouses. In addition, there is granted the right to divert the water from such ponds or reservoirs and conduct the same by flume, ditch, conduit, waterway, or pipeline to the point of use for the generation of power. However, such diverted water must be returned to its proper channel after being used. There is no authorization to interfere with any mill or powerplant under construction or in present operation or to take water powers with adjacent land necessary for their development. Certain mills, except cotton mills, presently in operation may be condemned upon a showing that a hydroelectric plant will benefit the public more than the continued existence of the presently operating mill. (Childs-Fla)
W69-09378

FISH AND GAME LAWS--LOCAL AND SPECIAL PROVISIONS.
NJ Stat Ann secs 23:9-22, 23:9-23, 23:9-27 to 23:9-29, 23:9-33, 23:9-35, to 23:9-38 (1940); NJ Stat Ann secs 23:9-24 to 23:9-26, 23:9-30 to 23:9-32, 23:9-34 (Supp 1969).

Descriptors: *New Jersey, *Fish toxins, *Fish conservation, *Fish management, Reasonable use, Fishing, Trawling, Nets, Fyke nets, Gill nets, Trapping, Equipment, Sport fishing, Toxins, Chemicals, Pollutants, Gasoline, Oil wastes, Water pollution, Regulation, Fishing gear, Seasonal, Legislation, Legal aspects, Delaware River.
Identifiers: Penalties (Civil), Limits.

This is a comprehensive article detailing the line fishing and netting laws applicable to the waters of the Delaware River and its tributaries in the state of New Jersey. The article, in its various sections, establishes seasons for netting, handline fishing, and rod and line fishing for game and food fish. Bag limits, minimum sizes and maximum weights are prescribed for many varieties of fish, along with the setting of seasons during which various fish may be taken. Many of the sections within the article, particularly those dealing with the use of nets in taking fish, and closed laws for fishing, state that any person violating the provisions of a section shall be subject to fine and forfeiture of boats, nets and other appliances used. One section is specifically directed against the intentional or negligent placing of deleterious substances, such as would harm fish, into the waters covered by the article. (Blunt-Fla)
W69-09379

PORT DISTRICTS.
For primary bibliographic entry see Field 04A.
W69-09380

SANDERS V PLANT (SUIT TO DETERMINE WHETHER ACCRETIONS FOLLOW THE LAND CONVEYED).

204 SW 2d 323-326 (Ark 1947).

Descriptors: *Arkansas, *Accretion (Legal aspects), *Riparian land, *Boundaries (Property), Real property, Riparian rights, Maps, Judicial de sions, State governments, Land tenure, Land fo ing, Land, Legal aspects, Ownership of beds, R tive rights.

Plaintiff brought action to have defendants joined from interfering with plaintiff's possessio certain lands. The court noted that the facts ou which this litigation arose were stated in a for appeal and would not be repeated. The issue volved was whether accretions to riparian l were conveyed with the land. The co unanimously accepted the general rule that a c veyance carries all the riparian rights of the l conveyed, including accretions. The court held t a separate conveyance of riparian rights is unnec sary unless there has been a severance of the rip an rights from the land conveyed. The evide showed that there had been a separation of accretions from the land. The court held that fendants had the original t itle to the accreti since plaintiff's deed from the state for the acc tions was void because of the state's lack of po to make the sale. (Shevin-Fla)
W69-09381

JOHNSON CITY V MILLIGAN UTIL DIST (TILITY DISTRICTS).
276 SW 2d 748-754 (Tenn Ct App 1954).

Descriptors: *Tennessee, *Public utilities, *Wa supply, *Public utilities district, Cities, Water ra Water conveyance, Pipes, Highways, Pub benefits, Legal aspects, Judicial decisions, Lo governments, Relative rights, Contracts.
Identifiers: Adverse possession, Injunctions.

The Utility District sought to take possession o water l ine which the city had used to supply area with water and which it claimed by adve possession. The District was created by legislati act to furnish water to the area. The pipe had be built by a private landowner and used by the ci but a quit-claim deed had conveyed title to the trict. The court determined that the city's right use the pipe could not be construed as conferri upon it the right to use the line for its own purpo over the objection of the owner. Uncertainties a ambiguities in the language of the deed should resolved in favor of the innocent purchaser. T court held that a purchaser would be justified in suming that the use of the line by the ci ty was inconsistent with the record of title. The co further stated that the city's use of the pipe show an intention to treat the service not as that o public utility but as being limited by private c tract. The city did not act as a public utility a could therefore not question the sufficiency notice of the hearing before the County Court the validity of its decree. (Shevin-Fla)
W69-09382

UNITED STATES V 2,648.31 ACRES OF LA (CONDEMNATION OF FLOWAGE RIGHTS).
For primary bibliographic entry see Field 04A.
W69-09383

RUSSELL FORK COAL CO V HAWKINS (L BILITY FOR FLOODING CAUSED BY ST MINING).
For primary bibliographic entry see Field 04A.
W69-09384

CONSTRUCTION OF DRAINAGE SYSTEMS.
For primary bibliographic entry see Field 04A.
W69-09385

ABANDONMENT OF HIGHWAY FOR C STRUCTION OF DAM; ACQUISITION LAND.
For primary bibliographic entry see Field 04A.
W69-09386

INING LANDS.
primary bibliographic entry see Field 04A.
-09387

INING LANDS.
primary bibliographic entry see Field 04A.
-09388

INING LANDS.

Ann Code Art 25, secs 52 to 86 (1957).

criptors: *Maryland, *Drainage districts, inage programs, *Surface drainage, Land mation, Controlled drainage, Drainage en-ering, Flood control, Drainage systems, Legal cts, Legislation, Construction, Ditches, Canals, erts, Local governments, Right-of-way, Ease-ts, Condemnation.

yland's boards of county commissioners are orized to establish public drainage associations eir respective jurisdictions, and to construct es, drains, and canals for the purpose of drain-wampy or overflowed lands, or lands subject to flow. Upon petition by affected landowners, county board shall appoint a board of drainage ers to study the feasibility of requests for age construction and to engage an engineer. county commission may assess proportionate s of the improvements against those persons will derive benefit, or it may allocate general ty funds for these projects. The board of age viewers then must report to the county mission regarding the practicality, public utili-nd expense of proposed improvements. The d of drainage viewers, upon approval of the ect by the commission, selects a board of agers for the drainage district to be created. managers are responsible for overseeing the age project and acquiring necessary ease-ts and rights-of-way. Condemnation procedure ailable to the board of managers if the owner of ied lands refuses to accept a duly authorized rd of damages. (Kelly-Fla)
-09389

IES OF DEPARTMENT OF CHESAPEAKE AFFAIRS.
primary bibliographic entry see Field 04A.
-09390

ULATIONS IN COUNTY WATERS.
Ann Code art 66C, secs 269 thru 285 (1957).

criptors: *Maryland, *Fishing, *Nets, *Regula-Local governments, Fish, Hunting, Riparian s, Rivers, Streams, Bays, Tributaries, Permits, slation, Legal aspects, Fish conservation, eation, Fishing gear, Water resources develop-t, Navigation.
tifiers: Non-residents.

statute sets forth specific regulations for vari-counties concerning water resources. These in-e primarily regulations on permissible times for ng, places for fishing, and the means of fishing ding the use of specific nets. The statute also rs licenses, non-resident requirements and ing-fishing conflicts. Several county provisions ct riparian rights and navigation rights. Some e sections contain specific sanctions. (Breeze-

-09391

BS, LOBSTER AND TERRAPINS.

Ann Code Art 66C secs 320, 322, 326, 330, 332, 334 (1957), as amended, (Supp 1968).

riptors: *Maryland, *Crabs, *Commercial fish, *Legislation, Permits, Boats, Nets, Rivers, daries, Bays, Inlets (Waterway), Aquatic als, Management, Regulation, Seasonal, Legal cts, Shellfish.

Identifiers: Licenses, Limits.

It shall be unlawful for any person to catch hard-shell crabs in any waters of the state between January 1st and April 1st of every year. Any person desiring to catch crabs for commercial use must first obtain a license in the county in which he resides. The license shall be good for one year and will entitle the holder to catch crabs only in the county where the license was issued. Nonresidents of the state shall not be permitted to catch crabs for market from the waters of the state. It is unlawful to catch any hard-shell crabs which measure less than five inches across the shell from tip to tip of the spikes, any peelers measuring less than three inches, any soft-shell crab measuring less than three and one-half inches, or any fat crabs or crabs with paper shells. Any person violating any provision of this section shall be guilty of a misdemeanor. (Shevin-Fla)
W69-09392

DRAINAGE DISTRICT UNDER 1920 ACT.
For primary bibliographic entry see Field 04A.
W69-09393

DAMS A ND DRAINS.
For primary bibliographic entry see Field 04A.
W69-09394

NORTHEASTERN WATER AND RELATED LAND RESOURCES COMPACT.
For primary bibliographic entry see Field 06B.
W69-09395

DELAWARE WATER AND AIR RESOURCES COMM'N.
For primary bibliographic entry see Field 06B.
W69-09396

TAX DITCHES.
For primary bibliographic entry see Field 04A.
W69-09397

DELAWARE COMMISSION OF SHELL FISHERIES.

Del Code Ann tit 7, secs 1901-1911 (1953), as amended (Supp 1966).

Descriptors: *Delaware, *Commercial shellfish, *Legislation, *Administrative agencies, Oysters, Clams, Permits, Legal aspects, State governments, Regulation, Leases, Beds under water, Shellfish, Boating regulations, Conservation.

The Commission is composed of five members, one of whom is elected president and one who is appointed executive secretary by the governor. Other personnel may be appointed by the Commission as necessary to carry out its duties. The Commission has full control and direction of the shellfish industry and of the protection of shellfish in the state, with general authority to promulgate and enforce appropriate regulations. The Commission: (1) operates, improves, and preserves oyster and clam beds; (2) regulates boats, equipment, or vessels used in the shellfish industry; and (3) issues permits and establishes charges and fees for taking shellfish. Provisions are made for leasing areas of specified bays to residents for planting and catching oysters and clams. Leases may be granted only to residents individually who are acting on their own behalf. In the performance of its duties the Commission is empowered to examine sworn witnesses, who may be subpoenaed to appear and subject to perjury charges for false testimony. A final section prohibits vacuum or suction mechanical devices for taking or catching shellfish. (Douberley-Fla)
W69-09398

ALLEN V NEW YORK STATE WATER RESOURCES COMM'N (DAMAGE FROM DAM CONSTRUCTION).
For primary bibliographic entry see Field 04A.
W69-09399

GRATHWOHL V HIWAY WONDERLAND INC (FLOOD DAMAGE FROM LOWER RIPARIAN DAM).
For primary bibliographic entry see Field 04A.
W69-09400

BROADWAY LAKE COMM'N, ANDERSON COUNTY.
For primary bibliographic entry see Field 06B.
W69-09401

RELEASE TO PARK COMMISSIONERS OF SHORE LANDS.
Ill Ann Stat ch 105, sec 325 (Smith-Hurd 1952).

Descriptors: *Illinois, *Riparian lands, *Riparian rights, *Local governments, Legislation, Legal aspects, Water law, Water policy, Water utilization, Reclamation, Public lands, Recreation, Parks, Administrative agencies, Recreation facilities, Land use, Cities, Beds under water.
Identifiers: *Public waters, Submerged lands.

When any city or town acquires control over lands bordering public waters and the riparian rights appurtenant thereto, it may grant such lands or rights for park purposes to the appropriate park commissioners or park board having control of any park within that city or town. Such city or town may also make agreements with such commissioners for the reclamation for park purposes of submerged lands under the public waters adjacent thereto provided that said commissioners never grant such lands to private parties. (Johnson-Fla)
W69-09402

OPEN SEASONS FOR, LIMITS FOR, AND METHODS OF TAKING CERTAIN WATER LIFE.

Ill Ann Stat ch 56, secs 163-191.7 (Smith-Hurd 1967), as amended, (Supp 1969).

Descriptors: *Illinois, *Fishing, *Wildlife conservation, *Regulation, Legislation, Wildlife, Fish, Wildlife management, Trout, Frogs, Bass, Fish conservation, Fishing gear, State governments, Nets, Shellfish, Crayfish, Seasonal, Legal aspects, Control, Mussels.
Identifiers: Limits.

Daily limits are set up for the taking of trout, bass, pickerel, and pike. Certain fish species may only be taken by hook and line. The open season and daily limits for bullfrogs are set. The method of taking certain species is provided for and other methods are prohibited. Ice fishing may only be done in the prescribed manner. Snag lines and snag poles are unlawful. Only two hooks may be used on any fishing pole or line. Certain fish may not be released in state waters without permission from the state. Snares, spears, and artificial lights are prohibited for the purposes of taking fish. Live carp and lamprey eels may not be used as bait. Firearms, airguns or gas guns may not be used to take bullfrogs. Certain fish may not be taken by pitchfork, spear gun, gig, or bow and arrow. A hook net turtle trap is unlawful to use if it does not meet certain dimensions. Nonresidents may not take turtles or crayfish by any means. Mussels may not be taken by mechanical devices. Fishing lines may not be attached to any portion of a tree other than the main trunk. (Heckerling-Fla)
W69-09403

CONTROL OF CERTAIN SALVAGE OPERATIONS.
For primary bibliographic entry see Field 04A.
W69-09404

STATE BOARD OF HEALTH SEWER SYSTEMS AND SEWAGE TREATMENT PLANTS.
For primary bibliographic entry see Field 05D.
W69-09405

ROCKY MOUNTAIN POWER CO V FEDERAL POWER COMM'N (FEASIBILITY INFORMATION REQUIRED BEFORE AUTHORIZATION OF POWER PLANT).

409 F2d 1122-1130 (DC Cir 1969).

Descriptors: *Judicial decisions, *Administrative decisions, *Hydroelectric plants, *Hydroelectric project licensing, Administrative agencies, Federal Power Act, Colorado, Electric power production, Electric power industry, Legislation, Cost analysis, Costs, Financial analysis, Financial feasibility, Financing, Marketing, Power marketing, Planning, Management.
Identifiers: Federal Power Commission.

Petitioner filed an application for authorization to construct and operate a hydroelectric project in January of 1961. A month later the Commission informed petitioner that it was insufficiently detailed in respect to provisions for financing the project and for marketing its output. At petitioner's repeated requests for extensions, the application was held pending for six years awaiting the necessary proof of economic and financial feasibility. At the hearing to consider the application, petitioner had produced no contracts for the sale of power. Since no financing plan could be compiled without prospective buyers, the application was dismissed without prejudice. Upon review of the Commission's order, the court affirmed the dismissal. Noting that the Commission had the power to require petitioner to submit reasonably adequate information denoting financial feasibility of the project, the court held that the dismissal was not unreasonable in light of petitioner's failure to show the project's feasibility. Since the Commission's order allowed petitioner to re-apply when the necessary financial information became available, it was unnecessary to hold the application pending any longer. (Douberley-Fla)
W69-09406

LOUISVILLE WATER CO INC V BOSLER (TORT LIABILITY FOR WATER DAMAGES FROM BROKEN CONDUITS).
For primary bibliographic entry see Field 04C.
W69-09407

RICE V OAKLAND COUNTY DRAIN COMM'R (ASSESSMENTS MUST BEAR RELATIONSHIP TO BENEFITS).
For primary bibliographic entry see Field 06C.
W69-09408

BARTLETT V ST ALKER LAKE SPORTSMEN'S CLUB (DEDICATION OF EASEMENT TO NON-NAVIGABLE LAKE).

168 NW 2d 356-361 (Minn 1969).

Descriptors: *Minnesota, *Easements, *Non-navigable waters, Access routes, Lakes, Riparian rights, Hunting, Game birds, Waterfowl, Right-of-way, Condemnation, Legal aspects, Judicial decisions, Remedies, Public rights, Public benefits, Relative rights, Riparian rights, Riparian land.
Identifiers: Dedication, Injunction (Prohibitory).

Plaintiffs owned a shallow, marshy, non-navigable lake and the lands surrounding it. In 1967, plaintiffs brought action to enjoin trespass upon and over one of the lots bordering on the lake. In 1954, a previous owner of this lot had granted to the public the right to hunt on the lake, insofar as he possessed that right, and had conveyed a perpetual easement across a portion of his lot to allow access. The following year a local sportsmen's club had bul ldozed an access route across this easement. The trial court found that the grant of hunting and easement rights constituted an offer to dedicate and that the clearing of an access route to the lake and the use of the land by hunters was sufficient to constitute acceptance. Thus defendants had not trespassed as they had legal right to be on the land. Plaintiff appealed. The supreme court affirmed, accepting the trial court's finding that a dedication and an acceptance had occurred. It held that riparian rights to the use of the entire overlying water exist even on a non-navigable lake. It also found that while the state cannot condemn access to a private non-navigable lake, access may be accepted when offered by the riparian owner. (Gabrielson-Fla)
W69-09409

DITTMAN V NAGEL (BREACH OF WARRANTY OF WELL WATER).
For primary bibliographic entry see Field 05F.
W69-09410

AALSBURG V CASHION (TITLE TO LAND CREATED BY ACCRETION).

167 NW 2d 902-904 (Ct App Mich 1969).

Descriptors: *Michigan, *Boundary disputes, *Accretion (Legal aspects), *Boundaries (Property), Judicial decisions, Lake shores, Land tenure, Real property, Legal aspects.
Identifiers: Adverse possession.

Third party defendant MacGregor sought a rehearing in the Michigan Court of Appeals on the question of whether title to certain lands created by accretion inured to him by adverse possession. The court of appeals affirmed its earlier holding that it was not adverse possession but was acquiescence. The court held that the evidence showed no definite boundary lines but only a 'live and let live' course of conduct. The court found that both parties had been using the same land over the years. Such usage of the land prevented any inuring of title by adverse possession. (Gadd-Fla)
W69-09411

IMPERIAL REFINERIES OF MINNESOTA INC V CITY OF ROCHESTER (ASSESSMENT FOR SEWER AND WATER IMPROVEMENTS).
For primary bibliographic entry see Field 06C.
W69-09412

TOWNSHIP OF GROSSE ILE V DUNBAR AND SULLIVAN DREDGING CO (RIPARIAN RIGHTS ARE SUBJECT TO PUBLIC RIGHTS).

167 NW 2d 311-316 (Ct App Mich 1969).

Descriptors: *Michigan, *Public rights, *Benefits, *Dikes, Landfills, Permits, Legislation, Riparian rights, Dredging, Rivers, Navigable rivers, Navigable waters, Islands, Channel improvement, Ownership of beds, Legal aspects, Judicial decisions, Remedies, Zoning.
Identifiers: Public trusts, Nonconforming use, Injunctions (Prohibitory).

Plaintiffs brought suit to enjoin defendant's dike and fill operation off an island in the Detroit River claiming that it violated a city zoning ordinance and impaired the public trust, the wildlife habitat and the public use of the area. The trial court granted an injunction on both of these theories and defendant appealed. The court of appeals affirmed. As to the violation of the city zoning ordinance, the trial court's finding that the dike and fill operation was not carried on to a sufficient extent prior t o the ordinance adoption to be deemed a nonconforming use was upheld. In regard to the violation of the public trust, the court noted that the title of a riparian owner in the bed of a navigable river is subject to a public trust for the preservation of the various public rights. Here, there was sufficient evidence to support the trial judge's conclusion that defendant's operation created a real and substantial impairment of the public's use of t
for hunting, fishing, and boating. (Gabrielso
W69-09413

**BATTJES BUILDERS V BOUMA (CO
DRAIN PROJECT).**
For primary bibliographic entry see Field 04
W69-09414

**FOND DU LAC METROPOLITAN SEWE
DISTRICT V CITY OF FOND DU
(ESTABLISHING A SEWAGE DISTRICT).**
For primary bibliographic entry see Field 05
W69-09415

**PEOPLE OF THE STATE OF MICHIG
JONDREAU (STATE JURISDICTION OV
DIANS ON THE GREAT LAKE).**

166 NW 2d 293-295 (Ct App Mich 1969).

Descriptors: *Michigan, *Fish conservation,
governments, *Boundaries, Judicial de
Legal aspects, Lake trout, Fishing, Indian r
tions, Treaties, Great Lakes, Beds, Feder
water rights conflict, Federal jurisdiction, S
risdiction, Regulation.
Identifiers: Keewenaw Bay, Chippewa tribe,
nity, Servitude.

The defendant, a Chippewa Indian, had b
rested for illegal possession of lake trout.
dant claimed immunity from state conse
regulations because of a federal treaty. Th
found that the defendant had caught the
Lake Superior, which was not on reservatio
Submerged lands of the Great Lakes adja
Michigan could not have been granted the
since they were owned by the state befo
treaty with the Indians. The court describ
question to be whether an Indian was sub
state game laws on non-reservation land de
f ederal treaty. The court decided that the
dant was subject to state game laws. The co
lied on United States Supreme Court de
which held that treaty provisions did not p
state fishing regulations in the interests of
vation. The court held that the regulation wa
when a reasonable and necessary exercise o
power was used, not discriminating against
dians. The court reconciled the regulations w
federal treaty in that the federal treaty only g
a privilege subject to the states' power
propriate regulation. (Gadd-Fla)
W69-09416

LAY OUT OF CLASS IV, V, VI HIGHWAY

NH Rev Stat Ann sec 234:48 (1964).

Descriptors: *New Hampshire, *Highways,
daries (Property), *Highway effects, Bo
disputes, Highway construction, Bridge co
tion, Bodies of water, Local governments, L
tion, Legal aspects, Cities.

When a highway is laid out across a body o
which constitutes the boundary betwee
towns, the commissioners shall determine t
to which each town shall construct, suc
thereafter constituting the boundary betwe
towns at the point. (Kahle-Fla)
W69-09417

**LIABILITIES OF TOWNS FOR DAM
CAUSED BY INADEQUATE BRIDGES OR
VERTS.**
For primary bibliographic entry see Field 04
W69-09418

WATER SUPPLY; SANITATION.
For primary bibliographic entry see Field 04
W69-09419

ER POLLUTION.
rimary bibliographic entry see Field 05G.
-09420

E CALUMET HARBOR.
rimary bibliographic entry see Field 04A.
-09421

EL OF LAKE MICHIGAN.
rimary bibliographic entry see Field 04A.
-09422

ERAL WATER POLLUTION CONTROL.
rimary bibliographic entry see Field 05G.
-09423

CAGO PARK DISTRICT AND CONSTRUC-N OF HARBOR FOR RECREATIONAL POSES.
rimary bibliographic entry see Field 04A.
-09424

KS: DRIVEWAYS AND BOULEVARDS.
nn Stat ch 105 secs 125-129 (Smith-Hurd).

riptors: *Illinois, *Recreation facilities, cs, *Road construction, Access routes, Land Riparian rights, Scenic highways, Legal ts, Legislation, Beds under water, Right-of-Public lands, Eminent domain.

oard of park commissioners having jurisdic-may extend a highway which connects to a c park bordering on public waters a distance o hundred feet over the bed of such public s. However, there must be no interference commercial navigation. A board of park com-oners contemplating an extension of this type prepare plans, make costs estimates, and e the consent of any affected riparian owners. ubmerged lands lying between the shore and ner line of the extended highway will be ap-iated by the board. The title to the extended vard or highway will vest in the board and will ne part of the public park. (Kelly-Fla)
09425

IATION AND MAINTENANCE OF HAR-FOR RECREATIONAL PURPOSES.
imary bibliographic entry see Field 04A.
)9426

ERCRAFT, RAFTS--PROCEEDINGS ON NG UP.
n Stat ch 50, sec 21 (Smith-Hurd 1966).

ptors: *Illinois, *Boats, *Regulation, ber, Value, Legislation, Watercourses), Floating, Legal aspects, Water law.
iers: Rafts, Ferries, Flat boats.

person stops or takes up any keel or flat boat, lat, batteau, pirogue, canoe, or other vessel tercraft found adrift on any watercourse the state and the same shall be valued at $15 re, he must, within five days, go before a of the proper county and make an affidavit ing such vessel. He must also detail the where the vessel was found and describe the board if any was found. (Shevin-Fla)
9427

ACE WATER PROTECTION DISTRICTS.
mary bibliographic entry see Field 04A.
9428

ACE WATER PROTECTION DISTRICTS.
mary bibliographic entry see Field 04A.
9429

SURFACE WATER PROTECTION DISTRICTS.
For primary bibliographic entry see Field 04A.
W69-09430

SURFACE WATER PROTECTION DISTRICTS.
For primary bibliographic entry see Field 04A.
W69-09431

SURFACE WATER PROTECTION DISTRICTS.
For primary bibliographic entry see Field 04A.
W69-09432

WOLF CREEK COLLIERIES CO V DAVIS (DAMAGE TO WATER WELL BY BLASTING OPERATIONS).

441 SW 2d 401-403 (Ky 1969).

Descriptors: *Kentucky, *Water loss, *Water wells, *Mining, Legal aspects, Judicial decisions, Water rights, Water sources, Water levels, Coal mines, Explosives, Underground streams, Underground, Explosions, Damages, Costs, Boundaries (Property), Water supply, Water table, Relative rights, Mining engineering, Barriers, Diversion, Channels, Land tenure, Reservoirs, Deep wells.
Identifiers: *Water depletion.

Plaintiff recovered $2500 as damages for depletion of a water well on his land. The jury determined such damages to have been caused by blasting in defendant's underground coal mine. On appeal the court granted defendant's motion for a mistrial based upon improper remarks by appellee's counsel. The court went on to consider the issue of liability which it felt would arise at a new trial. The court stated that liability from blasting does not rest on negligence and the only issues to be submitted to the jury are causation and damages. The court found that defendant's evidence that the mine was dry and that there were no cracks in the roof of the mine was not conclusive to show a lack of disturbance of barriers or channels under appellee's land such as would divert a watercourse or lower the water table. The court found that the plaintiff's evidence was sufficient to create a jury question. The judgment was reversed with directions for further proceedings in conformity with this opinion. (Shevin-Fla)
W69-09433

PURIFICATION OF WATERS--DRAINAGE OF PONDS.
For primary bibliographic entry see Field 05G.
W69-09434

RE-LOCATING WATERCOURSES.
For primary bibliographic entry see Field 04A.
W69-09435

HARBORS FOR RECREATIONAL USE.
For primary bibliographic entry see Field 04A.
W69-09436

WATERCOURSES, CANALS, WHARVES, AND LEVEES.
For primary bibliographic entry see Field 04A.
W69-09437

CONSTRUCTION OF WELLS AND WATER-WORKS.
For primary bibliographic entry see Field 04B.
W69-09438

REGULATION AND RESTRICTION IN THE LOCATION AND USE OF STRUCTURES.
For primary bibliographic entry see Field 04A.
W69-09439

DISCHARGE OF SEWAGE INTO OPEN DITCHES ALONG STREET OR HIGHWAY.
For primary bibliographic entry see Field 05G.
W69-09440

JONES V WELLMAN (BOUNDARY DISPUTE).

223 So 2d 572 (4th DCA Fla 1969).

Descriptors: *Florida, *Boundaries (Property), *Boundary disputes, *Streams, High water mark, Land, Real property, Land tenure, Legal aspects, Judicial decisions.
Identifiers: *Meander line.

Plaintiff brought an action for ejectment and from a ruling for defendant, took this appeal. Plaintiff contended that the correct boundary of his property was the high water mark of Taylor Creek and that all land between the meander line and the creek was his property. Defendant contended that the correct boundary was the meander line and that plaintiff was not entitled to the land in question. The appellate court held that the evidence supported the verdict for the defendant rendered by the jury and affirmed the decision. (Shevin-Fla)
W69-09441

GREAT LAKES BASIN COMPACT.
For primary bibliographic entry see Field 06B.
W69-09442

PRIVATE FISH HATCHERY.

Iowa Code Ann sec 109.54, 109.64 (1949).

Descriptors: *Iowa, *Fish hatcheries, *Regualtion, Breeding, Stocking, Fish harvest, Migration, Legislation, Natural streams, Buffalo fishes, Carp, Size, Fish stocking, Commercial fish, Commercial fishing, Permits, Legal aspects.
Identifiers: *Private waters, *Public waters, Propagation.

It shall be unlawful to operate a private fish hatchery or propagate fish native to Iowa in private waters without first obtaining a private fish hatchery license. Licenses shall not be issued to any hatchery that may be stocked with fish from public waters by overflow or natural migration. All fish acquired and distributed by private hatcheries must comply with state size and limit laws. Only native fish may be sold for stocking purposes within the state. Breeding stock must be obtained from licensed private fish hatcheries in the state or lawful sources outside the state. Fish lawfully taken by commercial fishermen may be held, fed and sold under private fish hatchery licenses. (Holt-Fla)
W69-09443

ANDERSEN V SCHMIDT (EASEMENT OVER LAND TO WATER'S EDGE).

168 NW 2d 437-439 (Ct App Mich 1969).

Descriptors: *Michigan, *Lake shores, *Easements, *Land tenure, Riparian land, Islands, Lakes, Shores, Boating, Land use, Legal aspects, Judicial decisions, Water law, Road construction, Boat-launching ramps, Docks, Marinas, Real property, Access routes.
Identifiers: *Boat house, Ingress, Egress.

One of defendants' predecessors in title granted to a predecessor of plaintiffs the right of ingress and egress over his land in order to get to a boathouse on the shore of Silver Lake. The agreement was recorded and appears in plaintiffs' chain of title. Plaintiffs own an island in the lake. The boathouse deteriorated and collapsed by 1960. Plaintiffs brought this action requesting the court to find an easement appurtenant over the defendants' land to the water's edge of Silver Lake. Judgment was granted for defendants and plaintiffs appealed. Plaintiffs contended the agreement created a per-

petual easement which would allow them to complete a road to the lake and construct a dock and other buildings for their use in getting to their island. The lower court held that when an easement is granted for a particular purpose it terminates when the purpose for which it was granted is abandoned. The appellate court upheld this determination and further found that the boathouse was essential to the purpose of the easement. Thus the collapse of the boathouse made the purpose of easement hopeless and impossible. The determination of the trial court was affirmed. (Shevin-Fla)
W69-09446

6F. Nonstructural Alternatives

SPECIAL FLOOD HAZARD INFORMATION, SHOAL CREEK, JOPLIN, MISSOURI.
Corps of Engineers, Tulsa, Okla.

Corps Eng Flood Plain Rep, Mar 1969. 5 p, 2 plate, 3 tab.

Descriptors: *Floods, *Flood damage, *Missouri, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Joplin (Mo), Standard project flood, Intermediate regional flood.

Flooding of Shoal Creek, Joplin, Missouri is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-09259

OPTIMIZING INVESTMENT IN FLOOD CONTROL AND FLOOD PLAIN ZONING,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
William Whipple, Jr.
Water Resources Research, Vol 5, No 4, p 761-766, Aug 1969. 5 p, 2 tab, 2 ref.

Descriptors: *Optimization, *Flood plain zoning, Benefit-cost ratio, Economics, Flood control, Non-structural alternatives.
Identifiers: Project-induced economic growth.

Recent governmental actions have accentuated flood plain zoning as an alternative to structural flood control. Optimization of investment between these alternatives requires consideration of project-induced development (economic development which would not occur if the project were not built) and site income (the return to the owner of new construction in the flood plain net of the cost of their development). These concepts are used to develop quantitative criteria applicable to determining to what extent zoning is practicable and to determining a correct benefit-cost ratio for the optimum solution. Results indicate that previously existing methods that do not take account of damages to project-induced growth may give unduly high benefit-cost ratios. It should normally be expected that a combination of flood control and zoning will be most productive. (Marriott-Chicago)
W69-09330

6G. Ecologic Impact of Water Development

PHYSICAL IMPLICATIONS OF LARGE-SCALE WATER TRANSFERS,
California Univ., Richmond. Sanitary Engineering Research Lab.
Percy Harold McGauhey.
IN W.G. McGinnies and B.J. Goldman, Eds., Arid Lands in Perspective, p 358-363, University of Arizona Press, Tucson, 1969. 6 p, 1 tab, 5 ref.

Descriptors: *Water transfer, *Evaluation, *Interbasin transfer, Arid lands, Arid climates, California, Export, Import, Municipal water, Water conveyance, Water distribution (Applied), Dissolved solids, Irrigation water, Impared water quality, Water pollution, Administration, Southwest U.S., Arizona, Irrigation programs, Planning, Riparian rights, Human population, Social impact.
Identifiers: North American Water and Power Alliance.

It is characteristic of most every effort man has made to shape his environment that he has viewed his objective more as an isolated task rather than as one facet of a complex system existing in a dynamic equilibrium, often with negative results. This paper explores one facet of such a task: physical implications of large-scale water transfers. The development of natural transfer systems, rivers, is traced, including riparian ownership, quality, quantity, and return-waters. Man-made transport systems are termed 'rivers in reverse'; problems of dissolved solids build-up, seepage, and riparian ownership are discussed. The physical results of long-term large-scale use of imported water in arid lands are considered. Several past projects are reviewed. The physical and social effects of not employing large-scale water transfers are explored. Objections to such schemes as the North American Water and Power Alliance are listed. The nature of the transfer systems involved may cause government, for good or evil, to guide land use planning and economic growth, control patterns of urbanization and meet some of man's recreational needs. (See W69-09210). (Sherbrooke-Ariz)
W69-09217

SOCIAL AND ECOLOGICAL IMPLICATIONS OF WATER IMPORTATION INTO ARID LANDS,
Texas Technological Coll., Lubbock.
Gerald W. Thomas, and Thadis W. Box.
IN W.G. McGinnies and B.J. Goldman, eds., Arid Lands in Perspective, p 363-374, University of Arizona Press, Tucson, 1969. 12 p, 7 fig, 38 ref.

Descriptors: *Water transfer, *Social impact, *Ecology, *Arid lands, Mosquitoes, Distribution patterns, Diversion losses, Fish management, Interbasin transfers, Land clearing, Water demand, Wildlife management, Long-term planning, Coordination, Decision making, Water resources development, Social aspects, Estuarine environment, Microenvironment, Terrestrial habitats, Wildlife habitats, Irrigation effects, Aquatic habitats, Balance of nature.
Identifiers: California State Water Project, Texas Water Plan, North American Water and Power Alliance, Australian Snowy Mountain, G reat Lakes Plan for the Amazon, Aswan High Dam.

Large-scale water movement to the arid zones appears to be inevitable. Pressures for these projects increase because they are technologically possible, economically possible, and may be necessary for society to survive and grow. Several examples of large scale water projects are presented; California State Water Project, Texas Water Plan, North American Water and Power Alliance, Australian Snowy Mountain, Great Lakes Plan for the Amazon, Aswan High Dam. The social and ecological implications of some of these projects are considered. Changes in fish species and populations, bird migratory routes and densities and terrestrial habitat destruction are documented. Wider mass use of insecticides, increases in mosquito populations, and alteration of microhabitats are to be expected. The authors urge that sound ecological studies be incorporated in the initial planning for large scale water movement. It is highly possible that ecological understanding could be the major factor in decision-making -- even overriding political, social or economic considerations. No example of good advanced planning involving the entire scientific community could be found. (See W69-09 (Sherbrooke-Ariz)
W69-09218

CHEREVKOVSKOY WATER-MEADOWS THE NORTH DVINA VALLEY. I. NATU CONDITIONS (RUSSIAN),
Leningrad State Univ. (USSR).
For primary bibliographic entry see Field 04D.
W69-09292

07. RESOURCES DATA

7A. Network Design

THE RAINFALL MEASUREMENT PROBLE
Hydrological Research Unit, Wallingford gland).
John C. Rodda.
Symp on Geochem, Precipitation, Evapora Soil-Moisture, Hydrom, Proc Gen Assembl Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pu 78, p 215-231, 1968. 17 p, 10 fig, 6 tab, 23 ref.

Descriptors: *Networks, *Rain gages, *Dist tion patterns, Hydrologic data, Instrumenta Rainfall disposition, Estimating.
Identifiers: *Rain gage location, *United King *Wallingford (U.K.), Error analysis.

Rainfall measurements are made in standard g installed with their rims at a fixed distance a the ground surface, but they are assumed to sure the rain actually reaching the ground. Bec the quantity of rain reaching the ground variably greater than the amount recorded standard gage, there is a systematic error in a surement of rainfall made in the conventional At Wallingford, Berkshire, United Kingdom, o period of 5 years, the total rainfall measured gage level with the ground surface was greater than that recorded by a gage at the star height of 1 ft, some 16 ft away. The differ between the gages had a summer minimum maximum in the winter and early spring, and was considerable daily variation. Measuremen wind speed and angle of rainfall were used to these differences, but without complete suc No patterns were found in the distribution of fall across the site. Splash was considered likely to affect the standard gage. Although th f erences in catch could not be entirely explain was concluded that the ground level gage w produce measurements nearest the real rainf was recommended that ground level rain should be installed alongside standard gage research purposes, especially in experimenta representative basins. (Knapp-USGS)
W69-09175

7B. Data Acquisition

APPLICATION OF DEEP ELECTRI SOUNDINGS FOR GROUNDWATER PLORATION IN HAWAII,
Geological Survey, Denver, Colo.
Adel A. R. Zohdy, and Dallas B. Jackson.
Geophysics, Vol 34, No 4, p 584-600, Aug 17 p, 19 fig, 1 tab, 20 ref.

Descriptors: *Electrical studies, *Geoph *Groundwater, *Hawaii, Surveys, Resistivity, trical resistance, Rock properties, Water Aquifers, Basalts, Saline waters-freshwater faces, Exploration.
Identifiers: Groundwater prospecting, Elec sounding.

Resistivity soundings, using Schlumberger equatorial dipole electrode configurations, made on the islands of Oahu and Hawaii to mine the applicability of direct current resis methods for locating freshwater aquifers i State of Hawaii. The soundings were made

thwestern part of the island of Oahu near the
n of Waialua and on the island of Hawaii of the
ddle' area near Pohakuloa and Humuula. In-
pretation of 32 sounding curves obtained on the
nd of Oahu indicates that it is possible to corre-
5 stratigraphic units underlain by a vesicular
alt basement and that the determination of the
proximate depth to the freshwater-saline-water
rface within the basalt is feasible. Near the
n of Waialua the aquifer is a coral zone as well
parts of the weathered vesicular basalt base-
nt. On the island of Hawaii, near Pohakuloa, an
loratory well drilled in basalt to a depth of 1001
rior to the resistivity survey proved to be dry. In-
pretation of 13 deep soundings made with
lumberger and equatorial arrays suggests that
minimum depth to a conductive layer, which
represent basalt saturated with freshwater, is
ut 2700 ft below land surface. The groundwater
ears to be dike-impounded. (Knapp-USGS)
9-09133

MPUTERIZED TEMPERATURE DECAY--AN
SET TO TEMPERATURE LOGGING,
iety of Petroleum Engineers of AIME, Dallas,
.
D. Cocanower, Billy P. Morris, and Mat
lingham.
etrol Technol, p 933-941, Aug 1969. 9 p, 8 fig,
ref.

scriptors: *Geophysics, *Surveys, *Tempera-
e, *Injection wells, Oil wells, Flooding, Oil reser-
rs, Permeability, Secondary recovery (Oil),
rage, Gases.
ntifiers: Injection temperature surveys.

measuring borehole temperature change rates
r shut-in and using computer extrapolation of
data, zones of injection may be defined precise-
Methods of calculation are illustrated with ex-
ples and results are presented in graphs and
rts. (Knapp-USGS)
9-09138

TELLITE APPLICATIONS TO SNOW
DROLOGY, 1968,
vironmental Science Services Administration,
ckville, Md.
bert W. Popham.
rld Meteorol Organ-Int Hydrol Decade Rep No
968. 10 p, 8 ref, 1 append.

scriptors: *Remote sensing, *Satellites (Artifi-
l), *Snow surveys, Snowpacks, Snowmelt,
wfall, Mapping, Surveys, Snow management,
dar, Photography, Data collect ions, Telemetry,
rain analysi s.
ntifiers: Satellite snow-measurement
hniques.

possibility of using satellite-borne remote
sing techniques to determine the areal extent
other characteristics of snow cover has been
er investigation for a number of years. During
past 3 years TIROS, NIMBUS and ESSA
eorological satellite photographs have been
d operationally by river forecast offices in the
tern United States to estimate snow cover.
se and other activities suggest that remote
sing from satellites can be applied practically to
w hydrology. Satellite snow-surveillance activi-
are summarized, existing and proposed satellite
rumentation applicable to snow hydrology are
ewed, and areas where further efforts could
d significant results in this field are suggested.
app-USGS)
9-09178

SH-WATER SPRINGS OF HAWAII FROM
RARED IMAGES,
logical Survey, Washington, D.C.
liam A. Fischer, Dan A. Davis, and Theresa A.
.
l Surv Hydrol Invest Atlas HA-218, 1 sheet,
6. Text, 28 fig, 1 plate, 1 tab, 2 ref.

Descriptors: *Remote sensing, *Springs, *Discharge (Water), *Hawaii, Infrared radiation, Mapping, Aerial photography, Cold springs, Fresh water, Surveys.
Identifiers: Hawaii County (Hawaii), Radiometry.

To study spring discharges into the ocean from the island of Hawaii, infrared images showing water temperatures in the ocean near the island were obtained in 1968. Positive prints from negatives made with electro-optical scanning radiometers show differences in apparent temperatures in shades of gray. Spring water shows on the prints because it is cooler than ocean water. Most discharge of water from Hawaii is in sea-level springs. Streamflow is intermittent because of extremely rapid infiltration into highly permeable volcanic rocks. Spring locations, areas of thermal anomalies, and descriptions are tabulated. Aerial photographs and radiographic prints are marked to show thermal anomalies and spring locations. (Knapp-USGS)
W69-09199

AIRBORNE REMOTE SENSING FOR GROUNDWATER STUDIES IN PRAIRIE ENVIRONMENT,
Department of Agriculture, Edmonton (Alberta). Water Resources Div.
M. E. Chase.
Can J Earth Sci, Vol 6, No 4, Part 1, p 737-741, Aug 1969. 5 p, 4 fig, 9 ref.

Descriptors: *Remote sensing, *Aerial photography, *Infrared radiation, *Groundwater movement, G lacial drift, Soil moisture, Vegetation effects, Water temperature.
Identifiers: *Canada, Alberta.

A deficiency of groundwater in an area of prairieland in southern Alberta prompted a survey by airborne remote sensors. Panchromatic and black and white true infrared photography coverages were obtained and studied, but were found to be of limited value. An infrared scanning survey, using the 2.5-5.6 micron band was flown at the same time and found to be more informative. Conditions of ground truth were not ideal, making the results less conclusive than desired. Till covers most of the area, with lake deposits on the eastern section. Soil moisture changes were registered on the imagery, but the depths of overburden to which these changes were recorded on the surface are unknown, due to the condition variations between the time of the survey and the drilling. Vegetation, surface water, soil moisture, and saline sloughs were found to have the strongest thermal signatures. Problems encountered in the survey are discussed and recommendations to eliminate them are given. (Knapp-USGS)
W69-09239

SOME GUIDELINES FOR REMOTE SENSING IN HYDROLOGY,
Geological Survey, Washington, D.C.
Charles J. Robinove, and Daniel G. Anderson.
Water Resources Bull, Vol 5, No 2, p 10-19, June 1969. 10 p, 4 fig, 9 ref.

Descriptors: *Remote sensing, *Surveys, *Hydrologic data, *Reviews, Aerial photography, Infrared radiation, Instrumentation, Mapping, Photogrammetry, Photometry, Terrain analysis, Telemetry, Satellites (Artificial).
Identifiers: Infrared imagery, Satellite photography.

Remote sensing in the field of hydrology is beginning to be appied to significant problems, such as thermal pollution, in many programs of the Federal and State Governments as well as in operation of many private organizations. A discussion of the subject is given to guide the hydrologist to a better understanding of how he may collect, synthesize, and interpret remote sensing data. The techniques discussed include color aerial photography, infrared aerial photography, infrared imagery and photogrammetry. Data reduction methods and equipment are briefly outlined. Like any other new technique remote sensing will eventually find its place in the resource disciplines. It wil l also have its pitfalls, many of which probably can be avoided by proper planning of projects and through knowledge of the capabilities of remote sensing systems. It is the task of the hydrologist, at this time, to assess his needs for data, to match them with the capabilities of remote sensing systems and the presently used data collection systems, and use them in the most beneficial way. (Knapp-USGS)
W69-09241

METEOROLOGICAL EXPERIMENTS FOR AUTOMATED SATELLITES,
National Aernautics and Space Administration, Washington, D.C. Dept. of Meteorology and Soundings.
William C. Spreen.
Water Resources Bull, Vol 5, No 2, p 20-35, June 1969. 16 p, 5 fig, 1 tab, 15 ref.

Descriptors: *Satellites (Artificial), *Meteorology, *Remote sensing, Surveys, Synoptic analysis, Weather forecasting, Aerial photography, Solar radiation, Winds, Clouds, Cloud cover, Energy budget.
Identifiers: Meteorology satellites.

The satellites used in meteorology include TIROS, ESSA Nimbus, and Applications Technology Satellite (ATS). The first three operate in the orbital altitudes of about 1000 to 1200 km while the fourth, ATS, is at geosynchronous altitude of 36,000 km. Cloud cover is observed operationally from low orbit and experimentally from synchronous altitude. Wind velocity has been inferred from the frequent cloud cover pictures taken by ATS, and satellite-balloon systems are being developed which will locate and track constant-density level balloons for determining wind flow. Spectrometers and radiometers operating in the electromagnetic spectral region from the ultraviolet to the microwave region are being developed to quantitatively measure temperature, water vapor, density and wind profiles. These will furnish data for the development and testing of atmospheric models for numerical prediction. In addition, experiments are being developed to measure ozone, other constituents of the air, solar energy, surface conditions, heat balance, and other atmospheric attributes which effect the structure and dynamics of the atmosphere. (Knapp-USGS)
W69-09242

TIME LAPSE AERIAL PHOTO ANALYSIS OF THE CONNECTICUT RIVER FROM 1952 TO 1965,
Massachusetts Univ., Amherst. Dept. of Forestry and Wildlife Management.
William P. MacConnell, and G. Peter Stoll.
Water Resources Bull, Vol 5, No 2, p 37-50, June 1969. 14 p, 9 ref.

Descriptors: *Aerial photography, *Photogrammetry, *Land classification, *Recreation, *Rivers, Land management, Surveys, Land appraisal, Land development, Land resources, Water quality, Streamflow, Floods, New England.
Identifiers: *Connecticut River.

Aerial photogrammetric techniques were developed and tested for identifying and classifying river-based recreation sites. A classification system was designed to describe the nature of the land itself, the land use, or the vegetation on the landscape. The Connecticut, a large river running through four states, was examined and classified using the system. Analysis of two sets of aerial photographs taken with a time lapse of 10 to 13 years enabled determination of past use and development trends. A catalogue of maps classifying strips of land adjacent to the river was prepared and reproduced for use by interested planning agencies. Statistics on land area by types for the river as it now is and as it was 10 to 13 years previously have been prepared by towns, counties, and

states. The aerial photographs proved invaluable for analyzing the recreational potential of the Connecticut River. (Knapp-USGS)
W69-09243

RADIOACTIVE METHODS FOR THE QUANTITATIVE DETERMINATION OF COASTAL DRIFT RATE,
Centre d'Etudes Nucleaires de Saclay, Gif-sur-Yvette (France).
G. Courtois, and A. Monaco.
Marine Geol, Vol 7, No 3, p 183-206, June 1969. 24 p, 14 fig, 2 tab, 25 ref.

Descriptors: *Sediment transport, *Littoral drift, *Tracers, *Tracking techniques, Radioisotopes, Marking techniques, Sediments, Sands, Radioactivity techniques.
Identifiers: Sediment tracking.

A new method, known as the count rate balance is presented for the quantitative evaluation of coastal drift. It is based on conventional radioactive tracer experiments to which are applied space integration measurements. The count rate balance operation consists of the determination, from the family of isocount curves, of the total number of counts detectable over the radioactive patch as a whole. Once the thickness of the layer in movement is known, the solid displacement rate can be calculated. This method was applied to a radioactive tracer experiment carried out on Apr. 20, 1967 on the Roussillon coast (southwestern France) by immersion of 4.2 kg of natural sediment labelled with 10 Ci of chromium 51 (half-life 27.8 days), at a depth of 4 m between 2 folds in the sea bed. The transport was governed by 2 dominant types of wind and swell conditions. From Apr. 20-29, swells from the north led to a southward displacement of about 1.05 tons/day/linear meter. The method has the advantage of requiring no special equipment apart from that needed in conventional radioactive tracer experiments, and no sampling is necessary. (Knapp-USGS)
W69-09247

RUNS OF PRECIPITATION SERIES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering; and Colorado State Univ., Fort Collins. Dept. of Mathematics and Statistics.
Jose Llamas, and M. M. Siddiqui.
Colo State Univ Hydrol Pap No 33, May 1969. 25 p, 7 fig, 7 tab, 6 ref, 2 append.

Descriptors: *Statistical methods, *Hydrologic data, Data processing, *Analytical techniques, Time series analysis, Statistics, Correlation analysis, Markov processes, Stochastic processes, Probability, Synthetic hydrology, Precipitation (Atmospheric).
Identifiers: Hydrological series analysis.

Three quantitative measures are introduced for the concepts of 'surplus' and 'deficit' in hydrologic series. These are: run-length, run-sum and run-intensity. Positive and negative runs of a series are defined in terms of a fixed value of the variable under consideration, in this case precipitation. The distribution function, moments, and other statistical properties of run-length, run-sum, and run-intensity, are obtained analytically, using two assumptions on the sequence of annual precipitations that it is independent and normally distributed and that it is independent and gamma distributed. For monthly precipitations the series was first standardized as a 2-state Markov chain with stationary transition probabilities. Annual precipitation from 27 stations in Colorado, and monthly precipitation from 219 stations in the Western United States are analyzed. (Knapp-USGS)
W69-09250

A NOTE ON THE EFFECT OF DISPERSION ON MEAN CURRENT MEASUREMENTS,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
For primary bibliographic entry see Field 02L.
W69-09252

AIRBORNE INFRARED RADIOMETER INVESTIGATION OF WATER SURFACE TEMPERATURE WITH AND WITHOUT AN EVAPORATION-RETARDING MONOMELECULAR LAYER,
Colorado State Univ, Fort Collins. Dept. of Atmospheric Science; and Wave Propagation Lab., Boulder, Colo.
For primary bibliographic entry see Field 03B.
W69-09253

QUATERNARY LAKES OF EASTERN BRAZIL,
Heidelberg Univ. (West Germany). Geological-Paleontological Inst.
For primary bibliographic entry see Field 02H.
W69-09260

PREDICTION OF WATER YIELD IN HIGH MOUNTAIN WATERSHEDS BASED ON PHYSIOGRAPHY,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 03B.
W69-09293

EVALUATION OF THE CARBON-14 TECHNIQUE FOR MEASUREMENT OF PRIMARY PRODUCTION,
Kaiser Foundation Research Inst., Richmond, Calif. Lab. of Comparative Biology.
M. B. Allen.
Proc 1st Nat Symp on Radioecology, Colorado State Univ, Ft Collins, Sept 10-15, 1961. Radioecology, 1963, Reinhold Pub Corp, NY and Amer Institute of Biological Sciences, Wash, DC, Schultz, Vincent and Klement Jr, Alfred W (Eds), p 477-480. 60 ref.

Descriptors: *Productivity, *Carbon radioisotopes, *Tracers, *Photosynthesis, *Phytoplankton, *Inorganic compounds, *Organic compounds, Light intensity, Light quality, Pigments, Nutrient requirements, Ecology, Sampling, Radioactivity, Carbon dioxide, Algae, Respiration, Chlorophyll.
Identifiers: Chromulina pusilla.

The carbon-14 (C-14) technique of measuring the production of organic material by natural populations is the best method currently available. Its application has stimulated considerable work on the relations between light, photosynthesis, pigmentation, and nutrition--all adding to understanding of phytoplankton ecology. This technique assesses amount of inorganic carbon converted into organic form by the photosynthesis of phytoplankton, almost completely supplanting other assay methods because of its great sensitivity. In this procedure, a prescribed amount of C-14 is introduced into a bottle filled with a water sample, the bottle is incubated, either in situ or in an illuminated incubator, for several hours; the cells are filtered off using a Millipore filter, treated to remove adsorbed or precipitated inorganic carbon, dried, and the C-14 concentration is measured. The problems are discussed in detail together with experiences of earlier investigators. They include, among others, size of samples, conditions for incubation, light screens, temperature, depth, time of day, proper pore size of filters, removal of adsorbed or precipitated inorganic carbon. It seems unlikely that a single correction for respiration covering all phytoplankters in all physiological conditions is possible. (See also Vol 2, No 19, Field 5C, W69-07863). (Jones-Wis)
W69-09333

7C. Evaluation, Processing and Publication

GEO-CHEMICAL CLASSIFICATION OF GROUNDWATER IN THE CARMEL REGION,
Hebrew Univ., Jerusalem (Israel). Dept. of Geology.
T. Dicker.
Israel J Earth-Sci, Vol 18, No 2, p 71-81, 1969. 1 p, 3 tab, append.

Descriptors: *Water chemistry, *Water quality, *Hydrogeology, *Groundwater, Solutes, Solubility, Aqueous solutions, Water analysis, Computer programs.
Identifiers: *Israel, Carmel region.

The Carmel region of Israel has an area of 180 km and yields about 50 mil lion cu m/yr of groundwater. The chemical composition of the water highly variable, reflecting the complex geology the area. A geochemical classification is presented to relate water quality to geology, and the method may have general applicability to all the groundwaters of Israel. A computer program is given aid in making the large volume of data accessible and to ease the geochemical computation used classification and mapping. (Knapp-USGS)
W69-09157

METHODOLOGY OF HYDROLOGIC MODEL BUILDING,
Geological Survey, Menlo Park, Calif.
David R. Dawdy, and R. W. Lichty.
Symp on Use of Analog and Digital Computers Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 347-355, 1968. 9 p, 2 fig, 2 tab, 12 ref.

Descriptors: *Model studies, *Rainfall-runoff relationships, *Computer models, *Mathematical models, Digital computers, Computer programs, Streamflow forecasting, Parametric hydrology, Infiltration, Surface-groundwater relationships, Simulation analysis, Optimization.
Identifiers: *Rainfall-runoff models.

Two alternative representations of the infiltration component of a rainfall-runoff simulation model are investigated. Four criteria for choice between the 2 which are considered are accuracy of prediction, simplicity of the model, consistency of parameter estimates, and sensitivity of results to changes in parameter values. Sensitivity plots are presented for obtaining an understanding of interactions in the model by studying several errors functions simultaneously. The tools presented are shown to aid in the subjective decisions which must be made in the construction and use of a rainfall-runoff model. (Knapp-USGS)
W69-09182

RAINFALL-RUNOFF MODEL FOR SMALL BASIN FLOOD HYDROGRAPH SIMULATION,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02A.
W69-09183

EXPERIENCES GAINED WITH DIGITAL COMPUTERS IN ANALYZING THE DISCHARGE AND THE RADIUS OF INFLUENCE OF WELLS IN POROUS AQUIFERS,
Design Bureau for Hydraulic Planning, Budapest (Hungary).
For primary bibliographic entry see Field 02F.
W69-09184

SIMULATION OF THE HYDROLOGIC-ECONOMIC FLOW SYSTEM,
Utah Water Research Lab., Logan. Dept. of Civil Engineering.
Murland R. Packer, J. Paul Riley, and Eugene K. Israelsen.
Symp on Use of Analog and Digital Computers Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 386-391, 1968. 6 p, 4 fig, ref.

Descriptors: *Mathematical models, *Computer models, *Water utilization, Irrigation water, Economics, Model studies, Planning, Optimization, Simulation analysis, Systems analysis, Analog computers, Evapotranspiration, Hydrologic budget, Crop production, Water management (Applied).

dentifiers: Economics of water use.

ncreased demands upon available land and water esources have resulted in detailed optimum-use onsiderations in terms of economic efficiency in vater resources planning and management. Effec- ive management of these resources requires an ex- amination of the hydrologic flow system and of the elated economic production functions. The elec- ronic analog computer is a valuable computational levice which can simulate the hydrologic and economic processes of a total system in water esource planning and development. The various economic hydrologic functions were interrelated by the mass continuity concept, by which it was possible to predict the flow of money and water within the system in terms of their occurrence in space and time. Water values are investigated by directing water to various alternative uses from a particular phase of agriculture. The resulting change in net benefits both to the system as a whole and to individual sectors of the economy are then observed. (Knapp-USGS)
W69-09185

ADAPTION OF ELECTRONIC COMPUTER FOR IMPROVED METHOD OF MODELING SURFACE RUNOFF FROM RAINFALL FOR SMALL WATERSHEDS,
Utah Water Research Lab., Logan. Dept. of Civil Engineering.
Roger A. Amisial, and J. Paul Riley.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 392-404, 1968. 13 p, 7 fig, 4 ref.

Descriptors: *Model studies, *Rainfall-runoff relationships, *Small watersheds, *Analog models, *Arizona, Routing, Streamflow forecasting, Mathematical models, Streamflow, Hydrographs, Synthetic hydrology, Analog computers, Overland flow.
Identifiers: Walnut Gulch (Ariz).

In the field of surface water hydrology, the fundamental equations of motion and continuity adequately portray the overland and channel flow phenomena. The differentail equations, however, are not easily amenable to solution, and their integration in closed form can be obtained only for extremely simplified cases. Techniques of integration by numerical methods have been developed, which can be handled by use of electronic computers. Combined with basic mathematical operations, the electronic analog computer can be successfully employed in the solution of surface runoff models described in terms of the 2 fundamental equations. The watershed is divided into subzones based on topography or physiography. The subzone is simulated by an equivalent rectangular basin transected by the main stream channel. Using the 2 fundamental equations of flow, the water is routed over the basin slopes with the rainfall as input and through the channel system which receives lateral flow from the basin slopes. Models based on the derived equations and on simplified forms of these equations are being developed in an attempt to assess the validity of these equations for some simplifying assumptions made in the usual routing procedures. Tests of the mathematical models are being made by simulating subbasins of the Walnut Gulch Experimental Watershed near Tombstone, Arizona. (Knapp-USGS)
W69-09186

THE USE OF STATISTICAL METHODS FOR SHORT-RANGE FORECASTS,
Hydrometeorological Service of the USSR (Moscow).
For primary bibliographic entry see Field 02E.
W69-09187

PROBLEMS IN SIMULATING AND EVALUATING VARIOUS METHODS OF LINEAR FLOOD ROUTING USING A SMALL DIGITAL COMPUTER,
University Coll., Cork (Ireland).
B. M. Harley, and J. C. I. Dooge.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 417-425, 1968. 9 p, 1 fig, 4 ref.

Descriptors: *Routing, *Mathematical models, *Computer programs, Digital computers, Linear programming, Flood routing, Flood forecasting, Synthetic hydrology, Data processing.
Identifiers: Flood routing model.

An IBM 1620 computer with 40 K storage and an on-line IBM 1311 disc unit was used to compute the complete linear solution for flood routing in a uniform open channel, to simulate this solution by a number of 2-parameter models, and a number of 3-parameter models, and to evaluate the errors of simulation. Sixteen individual programs were developed and then combined into a program system capable of operating a number of specified sequences of programs on a single input loading. (Knapp-USGS)
W69-09188

SYNTHESIS OF SEQUENCES OF SUMMER THUNDERSTORMS VOLUMES FOR THE ATTERBURY WATERSHED IN THE TUCSON AREA,
Arizona Univ., Tucson. Office of Hydrology and Water Resources.
For primary bibliographic entry see Field 02B.
W69-09190

PRINCIPLES OF MODELLING AND PROSPECTS OF USING ELECTRONIC COMPUTERS IN HYDROLOGICAL FORECASTING,
Hydrometeorological Service of the USSR, Moscow.
For primary bibliographic entry see Field 06A.
W69-09191

STUDY OF THE NUMERIC CALCULATIONS OF THE PROPAGATION OF FLOODS (FRENCH),
Laboratoire National d'Hydraulique, Chatou (France).
For primary bibliographic entry see Field 02E.
W69-09192

A DATA COLLECTION AND STORAGE SYSTEM USING A DIGITAL EVENT RECORDER,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research and Regional Survey.
M. J. Goodspeed.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 473-484, 1968. 12 p, 9 fig, 11 ref.

Descriptors: *Data collections, *Hydrologic data, *Data transmission, *Data processing, *Data storage and retrieval, Instrumentation, Computers, Digital computers, Measurement, Gaging stations, Gages, Telemetry.
Identifiers: Australia, Data recorders, Digital recorders.

A multichannel digital event recorder records rainfall, stage, well water level, temperature, wind, or combined data directly on computer compatible papertape and is designed for unattended operation remote from power supplies for periods up to one year. On input to a digital computer, data are converted to magnetic-tape files in a standard, condensed format. Routine abstract tabulations and more involved analyses can then be undertaken. The recorder is battery powered, and recharged by solar cells. (Knapp-USGS)
W69-09193

COMPUTER SIMULATION OF REMOTE SENSING BY MICROWAVE RADIOMETERS,
Ryan Aeronautical Co., San Diego, Calif.
E. Dedman, J. Culver, and F. Janza.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 485-497, 1968. 13 p, 4 fig.

Descriptors: *Remote sensing, *Model studies, *Simulation analysis, Mathematical models, Analog models, Digital computers, Systems analysis, Operations research.
Identifiers: *Microwave radiometers, Radiometry.

A computer simulation of airborne microwave radiometers as remote sensors for mapping thermal upwellings in the ocean is described. The importance of correlating 'ground truth' data to radiometer brightness temperature for deriving and validating mathematical models is pointed out. Methods of studying system characteristics using simulations are proposed and the value of such studies in reducing the cost of expensive field testing is emphasized. The benefits in utilizing analogous experience gained in the development of large space systems in evaluating remote sensing for hydrology are enumerated and specific analogies discussed. (Knapp-USGS)
W69-09194

USE OF DIGITAL COMPUTERS IN INTERNATIONAL WATER RESOURCES INVESTIGATIONS,
Food and Agriculture Organization of the United Nations, Rome (Italy).
R. G. Thomas.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 531-534, 1968. 4 p.

Descriptors: *Water resources development, *Planning, *Digital computers, *Model studies, Optimization, Economics, Data processing, Water management (Applied), Investment, Investigations.
Identifiers: United Nations.

A summary is presented of the use of digital computers for water resource projects in several countries. These projects are conducted by the Food and Agriculture Organization of the United Nations, funded by the United Nations Development Program. The difficulties which must be overcome include allocation of budget, location of computer near project area, training of United Nations personnel, and training of government counterpart personnel. Training is currently being carried out in field projects through use of short term consultants. Use of computers in water resource studies in less developed countries can provide better answers in order to minimize the risks of poorly considered capital investments. (Knapp-USGS)
W69-09195

COMPREHENSIVE INFORMATION RETRIEVAL IN THE FIELD OF WATER RESOURCES,
American Water Resources Association, Urbana, Ill.
For primary bibliographic entry see Field 10.
W69-09244

ANALYSIS OF SERIALS RELATED TO WATER RESOURCES,
Wolf Research and Development Corp., Riverdale, Md. Dept. of Special Studies.
For primary bibliographic entry see Field 10.
W69-09258

GENERATION OF FITTING PROBABILITY DISTRIBUTION FUNCTIONS OF DISCHARGES BY ELECTRONIC COMPUTER,
Research Inst. for Water Resources Development, Budapest (Hungary); and Eotvos Lorand Univ., Budapest (Hungary). Dept. of Theory of Probability.
M. Domokos, and D. Szasz.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci

Hydrol, Publ No 81, p 535-545, 1968. 11 p, 4 fig, 4 ref.

Descriptors: *Streamflow forecasting, *Mathematical models, *Digital computers, Probability, Statistical methods, Optimization, Regression analysis, Computer programs, Data processing, Water management (Applied), Hydrologic budget, Water balance, Hydrograph analysis.
Identifiers: *Hungary.

Water resources management requires a large amount of calculation of probability distribution functions of daily discharges. The normal, the logarithmic-normal and the gamma distributions were studied. Parameters of the distribution functions were estimated by the maximum likelihood method. Some details of the solution achieved by electronic computer include the ranging of sample elements according to order of magnitude, the computation of some parameters through solving an implicit system of equations by iteration, and some problems of the performance of the chi-squared test. Probability distribution functions of stream discharges were studied in the interest of water resources management in Hungary. (Knapp-USGS)
W69-09268

ON A PROBLEM OF FIXATION OF RESERVOIR CAPACITY SOLVED WITH THE HELP OF ELECTRONIC COMPUTER,
Central Water and Power Commission, New Delhi (India).
R. Rangarajan.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 546-554, 1968. 10 p, 4 fig, 4 ref, 1 append.

Descriptors: *Water management (Applied), *Reservoir design, *Data processing, *Digital computers, Computer programs, Estimating, Optimization, Reservoir operation, Streamflow forecasting, Water control.
Identifiers: *India.

An analytical approach based on the theory of dams by Moran is presented for developing a set of general curves relating storage capacity to the annual draft. The variables involved are expressed in standardized form so that the curves can be of general applicability. The annual inflow variable (or its known transform) is assumed to be normally distributed. Assuming the standardized inflow variable to take discrete values over the whole range, the probabilities of reservoir content before utilization are calculated for relevant combination pairs of capacity and annual draft. The process involved framing of sets of simulaneous equations of varying number of unknowns for different pairs of capacity and draft, and working out their solutions. The procedure, which is quite involved, could be easily run through an Electronic Computer. An idea of the general computer program in Fortran II prepared for the IBM 1620 Electronic Computer is also given. (Knapp-U SGS)
W69-09269

COMPUTER DOCUMENTATION AND RETRIEVAL OF HYDROLOGIC INFORMATION FOR SMALL RESEARCH GROUPS OR INDIVIDUALS,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 10.
W69-09270

DIGITAL COMPUTER APPLICATIONS THAT FACILITATE COLLECTION AND INTERPRETATION OF GROUNDWATER DATA,
Geological Survey, Lawrence, Kans.
Jesse M. McNellis, Charles O. Morgan, and Brent H. Lowell.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 561-568, 1968. 8 p, 6 fig, 7 ref.

Descriptors: *Computer programs, *Data processing, *Data storage and retrieval, *Data collections, Hydrologic data, Surveys, Mapping, Contours, Distribution patterns, Hydrography, Profiles, Gaging stations, Investigations.
Identifiers: US Geological Survey.

Well-inventory, water-quality, lithologic-log, and water-level data are basic to groundwater studies. Computer programs designed to facilitate the collection and processing of these data are coordinated with and are complementary to the design and implementation of coding forms, manuals, and systems. Digital computer programs developed in the Kansas District of the Water Resources Division, U.S. Geological Survey that materially aid hydrologists in field work include: checking, tabulation, standard analysis, and mapping or graphic-plot routines. Quality control of data is obtained by proofing computer output from checking and tabulation programs against source documents, so that errors infrequently occur in the results of subsequent programs. A hydrologist, with the assistance of frequently-updated computer output, can schedule field work more efficiently. The work plan can be selectively modified throughout the period that the hydrologist is engaged in relatively short test-drilling, well-inventory, or water-sampling phases of a project. The flexibility in scheduling and modifying field work obtained through usage of computer programs facilitates collection of groundwater data. This flexibility provides for better utilization of time, money, personnel, and equipment. (Knapp-USGS)
W69-09271

A DIMENSIONLESS REPRESENTATION OF FLOOD WAVE SUBSIDENCE BY MEANS OF A SUBSIDENCE FUNCTION,
Netherlands, Rijkswaterstaat.
For primary bibliographic entry see Field 02E.
W69-09272

ALTERNATIVE DIGITAL COMPUTER APPLICATIONS TO EVALUATE LINKED WATER RESOURCES,
Water Research Association, Medmenham (England).
M. J. Burley, and J. A. Cole.
Symp of Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 584-590, 1968. 7 p, 4 fig, 1 tab, 11 ref.

Descriptors: *Reservoir operation, *Water management (Applied), *Computers, Dynamic programming, Digital computers, Optimization, Desalination, Economics, Routing, Estimating, Conjunctive use, Regression analysis, Water demand, Time series analysis, Costs.
Identifiers: Linked reservoir systems.

Month-by-month control rules were formulated by digital computer for a pair of reservoirs meeting a common demand and for a single reservoir worked jointly with a seawater desalination plant. A dynamic programming approach was based on inflow probabilities, and allowed for 64 possible combinations of reservoir contents and preceding inflows. A search of 34 years of inflows was used to find a 'worst case' basis for deciding at what reservoir contents the desalination plant should start to operate. By adopting the control rule it was shown that the linked system reduced operating costs by 30 to 50% below those of a year-round supply by desalination. (Knapp-USGS)
W69-09273

A COMPUTER PROGRAM FOR ESTIMATING REGRESSIONS BETWEEN TIME SERIES,
Water Research Association, Medmenham (England).
R. T. Clarke.
Symp on Use of Analog and Digital Computer
Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass
Hydrol, Publ No 81, p 591-597, 1968. 7 p, 1 ta
ref.

Descriptors: *Statistical methods, *Computer
grams, *Time series analysis, *Regression anal
Correlation analysis, Charts, Estimating, Unifo
ty coefficient.
Identifiers: Statistical calculation program.

A computer program for time-series analysis wh
computes and graphs the spectrum of each se
the cospectrum, the quadrature spectrum and
coherence is described. An extension of the
gram may be used for multiple regression anal
The use of the program in study of hydrolog
time series is discussed. (Knapp-USGS)
W69-09274

**EVALUATION OF DROUGHT PERIODS
COMPUTER ANALYSIS: AN APPLICATION
SOUTHERN ITALY,**
State Hydrographic Service, Genoa (Italy);
Rari Univ. (Italy).
Samuele Cavazza, and Stefano Vannella.
Symp on Use of Analog and Digital Computer
Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass
Hydrol, Publ No 81, p 598-603, 1968. 6 p, 4 fig

Descriptors: *Synoptic analysis, *Droug
*Mathematical studies, *Digital computers,
matology, Duration curves, Mapping, Conto
Depth-area-duration analysis, Rain
Evapotranspiration, Evaluation.
Identifiers: *Italy, Drought analysis.

Problems arising in analysis of daily rainfall va
and frequency of rainy days are discussed and t
interest for agriculture is emphasized. Methods
examples are given to study the change of drou
spell duration throughout the year, taking diffe
totals of precipitations up to 50 mm as limit va
for drought. Regional maps of drought duration
shown. Distribution frequency is illustra
Periodic components for the time series of drou
duration values for a particular case are shown
their meaning is discussed. (Knapp-USGS)
W69-09275

**HYBRID COMPUTER SIMULATION OF
LOW-FLOW AUGMENTATION SUBSURFA
STORAGE SYSTEM,**
R. M. Shane, G. Mavrigian, and H. J. Day.
Symp on Use of Analog and Digital Computer
Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int As
Hydrol, Publ No 81, p 604-609, 1968. 6 p, 3 fi
tab, 5 ref.

Descriptors: *Model studies, *Computer mod
*Analog computers, *Digital computers, *L
flow augmentation, Conjunctive use, Groundwa
Water storage, Surface-groundwater relationsh
Artificial recharge, Aquifers, Glacial drift, Sa
Gravels, Water management (Applied), W
supply, Water utilization.
Identifiers: *Miami River (Ohio), Hybrid comp
model.

A hybrid computer program is described which
been developed to simulate the performance
subsurface storage system used for low-flow a
mentation of the Miami River (Ohio, U.S.A.).
simulator is used as part of a Monte C
procedure to compute probabilities and expec
values useful for evaluating the cost of the op
tion and the risk of a functional failure. The an
program is based on a discrete space-continu
time (DSCT) approximation to the non-linear
tial differential equations of groundwater flow i
unconfined aquifer obtained from an applicatio
Darcy's law and the principle of conservatio
mass. Synthetic streamflows are generated u
pseudo-random numbers on the digital compu
(Knapp-USGS)
W69-09276

DELLING OF HYDROLOGIC PROCESSES TH THE AID OF ELECTRONIC COMPU-S,
rometeorological Centre, Moscow (USSR).
primary bibliographic entry see Field 02A.
9-09277

MERICAL SOLUTIONS OF THE NAVIER KES EQUATION FOR FLOW THROUGH ALIZED POROUS MATERIALS,
versity Coll. of Townsville (Australia). Dept. of ineering.
primary bibliographic entry see Field 02F.
9-09278

LICATION OF STATISTIC METHODS FOR UTION OF STEADY AND UNSTEADY OUNDWATER FLOW,
lalek, and M. Novak.
p on Use of Analog and Digital Computers in rol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci rol, Publ No 81, p 724-737, 1968. 14 p, 3 fig, ef.

criptors: *Statistical models, *Groundwater ement, *Unsteady flow, *Computer models, tal computers, Monte Carlo method, Statistical hods, Probability, Synthetic hydrology, Porosi-ermeability, Elasticity.
tifiers: Statistical hydrology.

mathematical model is developed of plane ndwater flow in a deformable elastic medium er free water surface conditions. Linearized ations are used to describe unsteady flow and ndary conditions. A Monte Carlo method is l to describe water movement statistically. (K-o-USGS)
9-09279

F-SIMILAR SYNTHETIC HYDROLOGY,
Watson Research Center, Yorktown Heights,

Wallis, and B. B. Mandelbrot.
p on Use of Analog and Digital Computers in rol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci rol, Publ No 81, p 738-755, 1968. 18 p, 15 fig, , 19 ref.

criptors: *Statistical models, *Synthetic rology, Markov processes, Monte Carlo hod, Frequency analysis, Time series analysis, elation analysis, Regression analysis.
tifiers: Self-similar statistical processes.

ropriately chosen self-similar random esses provide much better fits to historical ological records than the current Markovian els. The experimental findings of Harold in Hurst on the range of white noise are full ac-ted for by such self-similar models. As a result, nay expect 'self-similar synthetic hydrology' to etter than Markovian models. Some of the nce is outlined and a sampling of the simula-results obtained thus far are briefly presented. pp-USGS)
-09280

ENGINEERING WORKS

Structures

LING POND DESIGN IN THE THWEST,
co Services, Inc., New York.
rimary bibliographic entry see Field 05B.
-09031

URAL DRAUGHT COOLING TOWERS - RYBRIDGE AND AFTER,
ution of Civil Engineers, London (England).
rimary bibliographic entry see Field 05D.
-09041

AERODYNAMIC IMPLICATIONS OF THE FERRYBRIDGE RESEARCH INVESTIGATIONS,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.
For primary bibliographic entry see Field 05D.
W69-09042

THE PROBLEMS OF ESTIMATING WIND LOADING ON STRUCTURES WITH SPECIAL REFERENCE TO COOLING TOWERS,
National Physical Lab., Teddington (England). Aerodynamics Div.
C. Scruton.
IN Natural Draught Cooli ng Towers - Ferrybridge and After, The Institution of Civil Engineers, p 85-89, 1967. 5 p, 5 fig, 1 tab, 10 ref.

Descriptors: *Cooling towers, *Structural design, *Model studies, Flow separation, Design criteria, Reynolds number, Wind velocity, Simulation analysis.
Identifiers: Pressure coefficient, Shape coefficient, *Wind-loading, *Ferrybridge, Code of practice, Wind tunnel.

The problem of estimating design wind forces and pressures on buildings and structures is divided into assessments of (a) the design wind speed, and (b) the shape and pressure coefficients. A considerable degree of uncertainty exists in the estimates of both the design wind speeds and the coefficients. A method for obtaining design wind speeds is described which is based on Shellard's maps showing the distribution of the maximum mean hourly wind speed at height 33 ft over the United Kingdom, and a simple procedure is given for converting these speeds to refer to gust speeds for shorter durations and to other heights. Maximum gust speeds averages over 10s and the extreme gust (less than 3s (seconds)) are recommended respectively for the consideration of stability and for the local pressures on cladding. For many structures the design demands more detailed and specific wind-loading data than are given in Codes. Consideration is given to the conditions under which wind-tunnel tests are conducted. Practical modeling difficulties lead to some uncertainty in extrapolating test results to full-scale towers. (Sherman-Vanderbilt)
W69-09055

SUPERVISION OF DAMS AND RESERVOIRS.
For primary bibliographic entry see Field 06E.
W69-09077

WIND RECORDS AND THEIR APPLICATION TO STRUCTURAL DESIGN,
British Meteorological Office, Bracknell (England).
H. C. Shell ard.
Natural Draught Cooling Towers-Ferrybridge and After, Proceedings of the conference held at the Institution of Civil Engineers (June 12, 1967), p 67-72, 1967. 1 fig, 1 tab, 16 ref.

Descriptors: *Wind pressure, Wind velocity, Flow profile, Frequency analysis, Structural design.
Identifiers: *Wind records, Topographic effects on winds, United Kingdom, Anemograph.

The nature of the continuous wind records that are maintained in the U.K. and the distribution of the stations providing such records to the Meteorological Office are described. The method of routine analysis of the records is indicated. For structural design purposes only the strongest winds are relevant and the statistical method used to analyze the annual extremes in order to obtain estimates of the probable maximum speeds likely to be exceeded only once in 50 or 100 years is outlined. Other important aspects affecting the choice of design speed for a structure are the variation of speed with height above the ground, the relationship between maximum speed and averaging time and the effects of ground roughness and topography. Current practices for dealing with these are described, indicating their background and what is being done to overcome certain limitations. (Ross-Vanderbilt)
W69-09309

COOLING TOWERS: STEP-CHILDREN OF INDUSTRY,
Lilie-Hoffmann Cooling Towers, Inc., St. Louis, Mo.
James Willa.
Heating, Piping and Air Conditioning, Vol 38, No 1, p 153-158, Jan 1966. 9 fig.

Descriptors: *Thermal pollution, *Cooling towers, *Maintenance, *Application methods, *Fungicides, *Thermal capacity, Chemical wastes, Distribution, Heat transfer.
Identifiers: *Polychlorophenate, *Delignification, *Soft rot, *White pocket rot, Plenum.

Regular and thorough maintenance of cooling towers is discussed, and an effective, safe, and economical method of spraying fungicides into plenum areas is recommended. The maintenance problems are recognized as pollution (chemicals in treatment), labor, safety, and economics. In a plant, the types of wood attack known are: delignification, (chemical), biological surface attack and internal fungus attack. The thermal capability of a tower can be seriously affected by minor neglect because it depends on the tower's distribution characteristics, or a constant ratio of water to air throughout the tower. The treatment involves assuring a pH of between 6.0 and 7.0 and applying a monoxidizing algaecide-fungicide and a chromate residual. A method of applying polychlorophenates directly in plenum areas has been developed. Economic considerations and equipment needs for these methods are presented. (Sherman-Vanderbilt)
W69-09312

WHAT LESSONS FROM FERRYBRIDGE.

Engineering, Vol 202, p 339-402, Sept 2, 1966. 6 fig.

Descriptors: *Cooling towers, *Failures, *Design criteria, *Structural engineering, *Structural stability, *Tensile stress, *Vibrations, *Reynolds number, Wind velocity, Pressure head, Model studies.
Identifiers: *Ferrybridge power plant, *Wind loading, Wind fluctuation, Wind tunnel experiments.

This article reports the technical factors of failure at the Ferrybridge power plant. Evidence from the collapse, eyewitness accounts and a later steeplejack inspection are considered. Although wind speeds did not reach the theoretical limit, the plant construction required an extrapolation of the structural dimensions, affecting its wind resistance capabilities. Furthermore, the validity of the wind loading data is questioned. The following recommendations are made for a more thorough study of the philosophy of cooling tower design including: (1) Design wind speeds and their conversion into wind pressures, (2) Factors accounting for grouping effects and fluctuating loads, (3) Factors accounting for structural considerations other than those mentioned, (4) Material strength characteristics for concrete and steel reinforcement. Specific studies of wind stress on cooling towers should be pursued intensively. There is a need for more data on gust characteristics. Wind loading should be specified more carefully or in simple functional terms, never as a dual specification. Meteorological data on t he probable maximum ten second average wind speed for a fifty year period is recommended to the designer. Research and development data should be immediately accessible to consultants and contractors. (Sherman-Vanderbilt)
W69-09313

HYPERBOLIC COOLING TOWERS WITH RESERVOIR STORAGE OF MAKEUP TO

SERVE THE PROPOSED KEYSTONE GENERATING STATION,
Gilbert Associates, Inc., Reading, Pa., and Pennsylvania Electric Co., Johnstown.
For primary bibliographic entry see Field 05D.
W69-09318

8B. Hydraulics

LAMINAR DISPERSION IN DIVERGING CHANNELS AND IN CONCENTRIC ANNULI,
Clarkson Coll. of Technology, Potsdam, N.Y.
William N. Gill, Ulku Guceri, and Richard J. Nunge.
Office of Saline Water Res and Develop Progr Rep No 443, June 1969. 37 p, 10 fig, 1 tab, 24 ref. OSW Grant No 14-01-0001-1096.

Descriptors: *Open channel flow, *Dispersion, Laminar flow, Convection, Hydraulics, Diffusion, Mixing, Model studies, Mathematical models.
Identifiers: Diverging channel flow, Peclet number, Annular channel flow.

Dispersion in flow in diverging channels, where the velocity decreases with axial distance is studied. Numerical experiments indicate that at sufficiently large values of the angle of divergence and Peclet number, both axial and transverse molecular diffusion play a minor role in the dispersion process and the system is dominated by convection. This is in marked contrast to parallel wall systems. A dispersion model was developed for such flows for limited ranges of the Peclet number and angle of divergence. At sufficiently large values of dimensionless time the dependence of concentration on both axial position and time can be represented by a single similarity coordinate. This behavior is predicted by both numerical solutions of flow equations and analytical solutions of the dispersion model. Dispersion in concentric annuli was considered also and an explicit expression for the dispersion coefficient was derived from first principles. (Knapp-USGS)
W69-09246

8C. Hydraulic Machinery

HYDRAULICS OF CIRCULATING SYSTEMS,
Tennessee Valley Authority, Knoxville.
Clifton W. Bolieau.
Journal of the Power Division, Proceedings of the ASCE, Vol 85, No PO1, p 1-22, February 1959. 4 fig, 2 tab, 5 ref.

Descriptors: *Tennessee Valley Authority Project, *Hydraulic engineering, *Hydraulic design, *Condensers, *Cooling water, Pump testing, Repairing, Pumping plants, Water level fluctuations, Valves, Slime, Conduits.
Identifiers: *Circulating water system, Vacuum system.

This paper discusses the factors entering into the design of condenser circulating water systems, with particular reference to those in the TVA project. These factors include determination of design flow, pump selection and setting, waterway design, air accumulation and removal, pump testing, and system operation. The TVA systems vary according to size, steam conditions, terrain, construction cost, value of power, quality and quantity of cooling water, water level fluctuations and others, so individual computations and structural decisions are made. The data is reported for each plant although the figures show typical structures. The design is discussed in terms of the most efficient operational principles and of materials and cost. Specific details are given for numerous design decisions encountered in the TVA system. (Sherman-Vanderbilt)
W69-09319

ROCKY MOUNTAIN POWER CO V FEDERAL POWER COMM'N (FEASIBILITY INFORMATION REQUIRED BEFORE AUTHORIZATION OF POWER PLANT).
For primary bibliographic entry see Field 06E.
W69-09406

OPEN-CHANNEL TRANSITIONS IN SUPERCRITICAL FLOW,
Pennsylvania State Univ., University Park, Coll. of Engineering.
F. L. Blue, Jr., and H. Y. Rajagopal.
Engineering Research Bulleti n B-98, April 1969. 85 p, 10 tab, 66 fig, 4 append. Available for $3.00 a copy from Engineering Publications, Hammond Bldg, Penn State Univ, University Park. 16802.

Descriptors: *Open channels, *Supercritical flow, *Transition flow, *Froude number, Channel flow, Water flow, Upstream, Downstream, Walls, Engineering structures, Uniform flow.
Identifiers: *Centerline, *Rectangular channel, *Trapezoidal channel, Wave patterns.

Transitions of three different shapes were tested for Froude numbers varying from 1.2 to 3.2, representing test flows of 0.57 to 4.47 cubic feet per second (cfs). Each transition connected an upstream rectangular channel with a downstream trapezoidal channel, all three parts lying on one straight centerline. One transition had warped walls. The other two effected the transitions with plane walls: one with a vertical surface above a sloping surface, the other with a sloping surface above a vertical one. The experiments with each of the three shapes covered combinations of five transition lengths with three depths in the rectangular approach channels. Thirty-one different transitions were investigated for the case of constant and continuous invert slopes equal to the rectangular channel slope for uniform flow. Graphs summarize the variation of the water surface along the channel walls and centerline, caused by the wave patterns of supercritical flow. These graphs indicate the complex wave patterns, and they are also a basis for designing transitions of the three shapes tested. A guide is offered for application of the extensive data to actual design. (Sink-Penn State Univ)
W69-09445

8H. Rapid Excavation

WOLF CREEK COLLIERIES CO V DAVIS (DAMAGE TO WATER WELL BY BLASTING OPERATIONS).
For primary bibliographic entry see Field 06E.
W69-09433

8I. Fisheries Engineering

FISH AND FISHERIES.
For primary bibliographic entry see Field 06E.
W69-09079

ATLANTIC STATES MARINE FISHERIES COMPACT.
For primary bibliographic entry see Field 06E.
W69-09080

ATLANTIC STATES MARINE FISHERIES COMPACT.
For primary bibliographic entry see Field 06E.
W69-09087

CONSERVATION--FISHING IN CERTAIN WATERS.
For primary bibliographic entry see Field 06E.
W69-09088

METHOD AND MANNER OF TAKING FISH.

NH Rev Stat Ann secs 211:1-211:17-C (1964), as amended, (Supp 1967).

Descriptors: *New Hampshire, *Fishing, *gear, *Fish, Fish conservation, Fish harve establishment, Fish populations, Fish manag Fish types, Sport fish, Sport fishing, Water Recreation, Ice, Regulation, Legislation, aspects, Hunting, Bodies of water, Ice fishi lakes, Permits, Lakes, R ivers, Streams, Tr mon, Carp, Fly fishing, Bait fishing, Baits, Seasonal, Expl osives, Poisons, Obstruction Weirs, Outlets, Inlets (Waterways), Nets, Gates, Water levels, Fry, Fertilizers, Sm terstate rivers.
Identifiers: Penalties (Civil), Bobhouse, pouts.

The method and manner of taking fish in th waters of New Hampshire is specifically re Use of nets and bow and arrow to take fish o restricted to certain species. Use of explosi structions to fish passage, water taps, jacklights, and other such devices and met take fish is prohibited. Only bait and fly fi permitted in certain waters. Ice fishing and bob houses is restricted to certain waters a ject to specific regulations. Only certain t fish may be legally used as live bait. L fishermen of each respective state sha reciprocal fishing rights upon interstate ponds and rivers. (C arruthers-Fla)
W69-09108

REGULATIONS IN COUNTY WATERS.
For primary bibliographic entry see Field 06
W69-09391

CRABS, LOBSTER AND TERRAPINS.
For primary bibliographic entry see Field 06
W69-09392

OPEN SEASONS FOR, LIMITS FOR, METHODS OF TAKING CERTAIN W LIFE.
For primary bibliographic entry see Field 06
W69-09403

PRIVATE FISH HATCHERY.
For primary bibliographic entry see Field 06
W69-09443

10. SCIENTIFIC AND TECHNICAL INFORMATI

COMPREHENSIVE INFORM RETRIEVAL IN THE FIELD OF W RESOURCES,
American Water Resources Association, U Ill.
Icko Iben.
Water Resources Bull, Vol 5, No 2, p 51-5 1969. 8 p, 7 ref.

Descriptors: *Reviews, *Bibliographies, resources, *Data storage and retrieval, *In tion retrieval, Documentation, Data colle Publications, Water resources develo Research and development, Data proc Digital computers, Data transmission.
Identifiers: Bibliography of current awa *Water resources literature, Current aw programs, American Water Resources Asso

The ages-old and ever-growing need for co cation and information retrieval among sc has found expression in the development dexes, abstracts, reviews and combinati variations of such. A short review of such e followed by a discussion of efforts along the in the new field of water resources scien technology. Such undertakings as the Infor Retrieval System of the American Society Engineers and of the U.S. Water Re Research Office are compared with that American Water Resources Association. (USGS)
W69-09244

YSIS OF SERIALS RELATED TO WATER URCES,
Research and Development Corp., Riverdale, ept. of Special Studies.
F. Johanningsmeier, Robert E. Frye, and F. Nasal.
S 706 available from the Clearinghouse for in paper copy or 0.65 in microfiche. Wolf d Develop Corp Rep, Mar 1969. 135 p, 1 fig, 29 ref, 11 append. OWRR Contract no 14-01-1610.

ptors: *Publications, *Water resources, eys, *Reviews, *Bibliographies, Libraries, nentation, Information retrieval, Data e and retriev al, Data transmission, Libraries, cts, Classification.
iers: Survey of Water Resources Publica-

l of 1964 serial titles with probable relevance field of water resources were identified. nen issues of approximately 900 serials were d in Washington, D. C. area libraries. Of 867 serials were found to satisfy the subject and serial criteria developed for this study and were analyzed in depth. Selected information on each serial was recorded individually on a data sheet developed specifically for this project in conjunction with the staff of the Water Resources Scientific Information Center. In addition, a data file system providing for storage, maintenance, and retrieval of data on each serial was designed and put into service. Some of the current characteristics of water resources serials are discussed with particular emphasis on primary scientific or technical serials. Recommendations, based upon the findings of the study, are made for the inclusion of additional serials in the data file system. (Knapp-USGS)
W69-09258

COMPUTER DOCUMENTATION AND RETRIEVAL OF HYDROLOGIC INFORMATION FOR SMALL RESEARCH GROUPS OR INDIVIDUALS,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Henry W. Anderson, and Theodor B. Yerke.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 555-560, 1968. 6 p, 1 tab, 31 ref.

Descriptors: *Information retrieval, *Documentation, *Data storage and retrieval, *Data processing, *Computer programs, Digital computers, Bibliographies, Classification, Editing, Publications, Reviews, Abstracts, Data collections.
Identifiers: Small-operation data systems.

The development of computer-based information handling systems designed to give direct support to the documentation and retrieval needs of individual researchers has received scant at tention. The difference between personal-use systems and large, library-oriented systems is not well understood. The U.S. Forest Service has developed a personal documentation system (FAMULUS) which 'automates' a personal file and provides updating, editing, vocabulary-building, and searching capabilities. Use of FAMULUS in preparing a summary of sedimentation research in the United States is illustrated. (Knapp-USGS)
W69-09270

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Wisconsin Water Resources Center	W69-09227	1
	Total	413

* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—392-124 (8)

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- 4 WATER QUANTITY MANAGEMENT AND CONTROL
- 5 WATER QUALITY MANAGEMENT AND PROTECTION
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VOLUME 2, NUMBER 23
DECEMBER 1, 1969

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Selected Water Resources Abstracts is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the Clearinghouse for Federal Scientific and Technical Information (CFSTI) of the Bureau of Standards, U. S. Department of Commerce. It is available to Federal agencies, contractors, or grantees in water resources upon request to: Manager, Water Resources Scientific Information Center, Office of Water Resources Research, U. S. Department of the Interior, Washington, D. C. 20240. Annual subscription is $22.00 (domestic), $27.50 (foreign), single copy price is $3.00. Certain documents abstracted in this journal can be purchased from the Clearinghouse at the prices indicated in the entry. Prepayment is required.

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 2, NUMBER 23
DECEMBER 1, 1969

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As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.

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- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the FWPCA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

In cooperation with the Federal Water Pollution Control Administration, the following "centers of competence" have been established:

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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. NATURE OF WATER

A. Properties

DROCALCITE AND NESQUEHONITE IN RBONATE SCALES,
idelberg Univ. (West Germany). Sediment Lab.
primary bibliographic entry see Field 02K.
9-09449

THE INTERACTION OF WATER OLECULES AND MONTMORILLONITE SUR-CES,
claide Univ. (Australia). Dept. of Agricultural chemistry and Soil Science.
primary bibliographic entry see Field 02G.
9-09481

SORPTION OF WATER ON SILICA,
rning Glass Works, N.Y.
Hertl, and M. L. Hair.
ture, Vol 223, No 5211, p 1150-1151, Sept 13, 9. 2 p, 2 fig, 5 ref.

scriptors: *Water structure, *Water chemistry, lica, *Adsorption, *Thermodynamics, Viscosi-Condensation, Interfaces, Hydrogen bonding. ntifiers: *Water polymers, Adsorption herms.

ter was condensed on a silica surface from ich all freely vibrating hydroxyl groups were noved, to study a possible structure of anoma-s water or water polymer. In 9 runs in which ter vapor was progressively admitted to the tem, 2 distinct knees appeared on the adsorption therm, corresponding to adsorption of 1 and 3 lecules adsorbed on H-bonded surface hydroxyl ups. A third knee at 17 torr corresponds to ad-ption of a third water layer on the silica surface. e number of layers at saturation is estimated to 6. A flat hexagonal structure composed of 6 ter molecules in 3 layers is proposed. If the ucture were released from the surface it could duce a polymeric species with the high viscosity ociated with the anomalous water reported el-here, although the models of structure differ in t the previously reported hexameric structure is ahedral rather than hexagonal-planar. (Knapp-GS)
9-09652

OMALIES IN THE THERMAL PROPERTIES WATER,
rence Univ. (Italy). Dept. of Physical Chemis-

Cini, G. Loglio, and A. Ficalbi.
ure, Vol 223, No 5211, p 1148-1149, Sept 13, 9. 2 p, 3 fig, 24 ref.

scriptors: *Water structure, *Water properties, agnetic studies, *Surface tension, *Interfaces, sical properties, Thermodynamic behavior, ndary processes.
ntifiers: Interfacial tension, Magnetic suscepti-ty, Surface chemistry.

gnetic susceptibility and interfacial tension of er-hexane and water-decane systems were stu-d to determine whether thermal irregularities in magnetic susceptibility of water are due to bulk nterfacial effects. Experimental data are shown hically. In all runs irregularities always ap-red at the same temperatures, within 0.5 deg C, oth interfacial tension and in magnetic suscepti-y. The interfacial origin of the anomalies is also wn by magnetic data of samples of water-silica systems. The irregularities are probably caused, ll systems studied, by ordered water structure at phase interfaces. (Knapp-USGS)
9-09653

INFERENCE OF STRATOSPHERIC TEMPERATURE AND MOISTURE PROFILES FROM OBSERVATIONS OF THE INFRARED HORIZON,
GCA Corp., Bedford, Mass.
For primary bibliographic entry see Field 02B.
W69-09659

POLYWATER,
Maryland Univ., College Park. Center for Materials Research; and National Bureau of Standards, Washington, D.C.
E. R. Lippincott, R. R. Stromberg, W. H. Grant, and G. L. Cessac.
Science, Vol 164, No 3887, p 1482-1487, June 1969. 6 p, 5 fig, 1 tab, 19 ref.

Descriptors: *Water structure, *Water chemistry, *Surfaces, *Hydrogen bonding, Molecular structure, Water properties, Absorption, Infrared radiation, Thermodynamics, Thermal properties.
Identifiers: *Anomalous water, *Polywater, Water polymers, Raman spectra, Infrared absorption spectra.

Recent reports of anomalous water or polywater by Russian and U.S. workers are reviewed and results of a study by the U.S. Bureau of Standards and the University of Maryland are discussed. The infrared and Raman spectra of a form of water prepared in fused quartz capillaries and previously designated as 'anomalous' water have been obtained. The infrared spectra appear to be unique, with the apparent absence of the O--H-stretching bands prominent in normal water spectra, and the appearance of new bands near 1600 and 1400 cm. The interpretation is that new and previously unreported strong symmetric O-H-O bonds are formed. These bonds are regarded as responsible for the remarkable properties of the material and have considerable covalent character. They are so strong that they cannot be considered as normal hydrogen bonds. The bond energy per O-H-O unit is given as approximately 125 to 210 kjoule/mole (30 to 50 kcal/mole), and an energy of 250 to 420 kjoules (60 to 100 kcal) per structural unit. Several structures are proposed which are consistent with the spectral data and the remarkable properties and stability of the material. It is concluded that the material is a true polymer of water and, therefore, is named polywater. (Knapp-USGS)
W69-09664

1B. Aqueous Solutions and Suspensions

STEADY GRAVITATIONAL CONVECTION INDUCED BY A LINE SOURCE OF SALT IN A SOIL,
Agricultural Research Service, Madison, Wis.
For primary bibliographic entry see Field 02G.
W69-09475

CHEMICAL SEPARATION AND SPECTROCHEMICAL DETERMINATION OF MICROGRAM QUANTITIES OF GERMANIUM IN NATURAL WATER OF HIGH HEAVY-METAL CONTENT,
Geological Survey, Sacramento, Calif.
For primary bibliographic entry see Field 02K.
W69-09684

02. WATER CYCLE

2A. General

NUMERIC STUDIES OF A COMPOSITE SOIL MOISTURE GROUNDWATER SYSTEM,
Drexel Inst. of Tech., Philadelphia, Pa.
For primary bibliographic entry see Field 02G.
W69-09462

DETERMINATION OF AQUIFER DIFFUSIVITY FROM AQUIFER RESPONSE TO FLUCTUATIONS IN RIVER STAGE,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W69-09467

SEPARATION OF RAINFALL EXCESS FROM TOTAL RAINFALL,
Washington State Univ., Pullman.
For primary bibliographic entry see Field 02B.
W69-09469

IN-PLACE DETERMINATION OF PERMEABILITY DISTRIBUTION FOR HETEROGENEOUS POROUS MEDIA THROUGH ANALYSIS OF ENERGY DISSIPATION,
Battelle Memorial Inst., Richland, Wash.
For primary bibliographic entry see Field 02F.
W69-09500

AREAL SWEEP EFFICIENCY OF PSEUDOPLASTIC FLUIDS IN A FIVE-SPOT HELE-SHAW MODEL,
Shell Development Co., Houston, Tex.
For primary bibliographic entry see Field 02F.
W69-09502

WATER RESEARCH PROGRAMS - AQUATIC COMMUNITIES,
Academy of Natural Sciences, Philadelphia, Pa. Dept. of Limnology.
For primary bibliographic entry see Field 06G.
W69-09508

THE USE OF SINGLE-PARAMETER DENSITY MODELS TO STUDY THE THERMOHALINE CIRCULATION IN AN OCEAN OF FINITE DEPTH,
University of the Far East.
V. F. Kozlov.
Atmos and Oceanic Phys, Vol 4, No 6, p 354-360, June 1968. 7 p, 2 fig, 1 tab, 26 ref. Transl from Izv, Akad Nauk, SSSR, Atmos and Okean Fiz, Vol 4, No 6, p 622-633, 1968.

Descriptors: Ocean circulation, *Salinity, *Density, *Mathematical models, Ocean currents, Diffusion, Mixing, Convection, Oceanography, Water circulation, Density currents.
Identifiers: USSR, Thermohaline circulation.

A general procedure is suggested for the use of single-parameter density models to solve the problem of the stationary circulation in an ocean of finite-depth. The equation obtained is solved numerically by computer. The depth distribution of the baroclinic layer in a rectangular ocean is computed. (Knapp-USGS)
W69-09509

CALCULATING THE GENERAL CIRCULATION AND CURRENTS IN THE NORTHWESTERN BLACK SEA,
Akademiya Nauk SSSR; and Gidrometeorologicheskii Institut, Odessa (USSR).
D. M. Tolmazin, and V. A. Shnaydman.
Atmos and Oceanic Phys, Vol 4, No 6, p 361-368, June 1968. 8 p, 8 fig, 1 tab, 13 ref. Transl from Izv, Akad Nauk, SSSR, Atmos and Okean Fiz, Vol 4, No 6, p 634-646, 1968.

Descriptors: *Ocean circulation, *Ocean currents, *Hydrologic budget, *Salinity, *Winds, *Inflow, Topography, Mass transfer, Mathematical models, Digital computers, Water circulation, Oceanography, Waves (Water).
Identifiers: *Black Sea, *USSR.

The general circulation in the northwestern Black Sea is calculated from the known wind field, river discharge, and bottom relief, taking account of the exchange of water with the open sea. A model of

steady homogeneous-fluid motion is used for the calculation. Observational data are used in making preliminary estimates of the horizontal grid spacing and of the accuracy of the solution. The stream function is calculated by Seidel's method. Patterns of the stream functions, surface currents, and free-surface relief are given for several wind situations in the northwestern Black Sea. Various factors affecting the process are analyzed. (Knapp-USGS)
W69-09510

METHODS OF STRUCTURAL AND GEOMORPHOLOGICAL ANALYSIS OF RIVER VALLEYS (RUSSIAN),
Kharkov State Univ. (USSR).
I. G. Chervanov.
Kharkov Univ, Vestnik Geol i Geogr, Ser No 25, No 2, p 83-85, 1967. 3 p.

Descriptors: *Geomorphology, *Mathematical studies, *Geologic control, *Structural geology, River basins, Topography, Slopes, Streamflow, Sediments, Floods, Maps, Mapping, Methodology.
Identifiers: *USSR, Terrace profile, Geomorphological methods.

Various structural and geomorphological elements of the Styr and Ikva River valleys were analyzed and plotted on the same map. These plotted elements consisted of (1) a longitudinal stream profile; (2) graphs characterizing the forms of transversal profiles; (3) geologico-geomorphological profiles of river terraces; and (4) the geomorphological scheme of the river valley. The longitudinal profiles of the rivers were analyzed using the concepts of deformation coefficient and coefficient of stream slope developed by Yu. A. Mescheryakov and then plotted on the map. The study shows that the combination of these geomorphological and geological profiles permits the evaluation of the tectonic processes acting in the past as well as the evaluation of the thicknesses and lithological characteristics of the formations present in a river valley. (Gabriel-USGS)
W69-09514

TECHNIQUES OF HYDROLOGIC RESEARCH IN FORESTED PEATLANDS, U.S.A.,
Forest Service (USDA), Grand Rapids, Minn. North Central Forest Experiment Station.
For primary bibliographic entry see Field 07B.
W69-09571

QUICK-RETURN SUBSURFACE FLOW,
Agricultural Res Service, Beltsville, Md. Hydrograph Lab.; and Agricultural Research Service, Madison, Wis. Soil and Water Conservation Div.
For primary bibliographic entry see Field 02G.
W69-09665

A PRELIMINARY REPORT ON AN EMPIRICAL ANALYSIS OF DRAINAGE NETWORK ADJUSTMENT TO PRECIPITATION INPUT,
Idaho Univ., Moscow.
Roy E. Williams, and Phillip M. Fowler.
J Hydrol, Vol 8, No 2, p 227-238, June 1969. 12 p, 2 fig, 1 tab, 13 ref.

Descriptors: *Rainfall-runoff relationships, *Geomorphology, *Drainage density, Erosion, Hydrogeology, Streams, Terrain analysis, Topography, Model studies, Surveys, Discharge (Water), Streamflow.
Identifiers: Drainage basin analysis.

In an analysis of the effect of precipitation on drainage network adjustment and on cumulative stream discharge, seven 4th-order drainage basins in each of 2 areas were investigated. Both areas are covered by glacial till and have similar precipitation intensities and thunderstorm frequencies, but one area receives approximately 30% greater average annual precipitation than the other,. Values of certain geomorphic parameters were determined for each basin and these values were compared statistically. As might be expected from considerations based on Horton's law the number of segments per order per unit area of a 4th-order basin in the wetter area is systematically related to that in the drier area. The analysis indicates that a basin of a given order in the drier area contains more segments of every order than does a basin of the same order in the wetter area. But on a unit area basis more segments per order per unit area of 4th-order basins occur in the wetter area. Runoff data indicate that cumulative stream discharge per segment per order per unit area should be appreciably greater in the wetter area than in the drier area. On the basis of data collected from the 2 areas it appears that some variable other than precipitation, materials, evapotranspiration, and precipitation intensity is operative in the adjustment process. This variable may be initial relief. (Knapp-USGS)
W69-09671

A COMPREHENSIVE RAINFALL/RUNOFF MODEL FOR AN UPLAND CATCHMENT AREA,
Dee and Clwyd River Authority (Wales).
A. O. Lambert.
J. Inst Water Eng, Vol 23, No 4, p 231-238, June 1969. 8 p, 4 fig, 2 tab, 6 ref.

Descriptors: *Rainfall-runoff relationships, *Routing, Streamflow forecasting, Recession curves, Hydrographs, Hydrograph analysis, Water storage, Streamflow, Water balance, Mathematical models, Model studies.
Identifiers: *Wales, Watershed models.

Using hydrometric data from an upland river in North Wales, a relationship between rate of river flow and water stored within the catchment area (catchment storage) is assumed to exist, and is evaluated from an analysis of winter recession curves. This storage/river flow relationship, when combined with water balance equations, produces a set of equations which may be used for routing inputs of rainfall through a storage with defined outflow characteristics, providing a straightforward method of flood prediction and analysis from rainfall data. Recorded and predicted flood hydrographs are compared, and the effectiveness and limitations of the method are considered. The development of a complete mathematical model, embodying the storage/river flow relationship, and suitable for generation of continuous run-off records from rainfall and evaporation data, is also considered. (Knapp-USGS)
W69-09674

CALIBRATING A WATERSHED BY USING A CLIMATIC DATA,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
Irvin C. Reigner.
USDA Forest Service, Research Paper NE-15, 45 p, illus, 1964.

Descriptors: *Hydrograph analysis, *Watershed management, *Calibrations, *Rainfall-runoff relationships, Storm runoff, Watersheds (Basin), Antecedent precipitation, Evapotranspiration, Climatic data, Pennsylvania, Estimating equations.
Identifiers: *Experimental watersheds, Hydrologic analysis, Groundwater storage, Soil moisture storage, Climatic variables.

In a single-watershed calibration of the experimental Dilldown Watershed in Pennsylvania, equations were developed for predicting annual runoff and monthly water loss or runoff. The basic relationships were developed from streamflow, climatic, groundwater, and soil-moisture records, but the final equations were expressed in terms of runoff and climatic variables only.
W69-09759

2B. Precipitation

PRODUCTION OF ISOLATED PAIRS WATER DROPS HAVING UNEQUAL RAD
National Center for Atmospheric Res
Boulder, Colo.
For primary bibliographic entry see Field 07B
W69-09448

CARBON-14 IN PATAGONIAN TREE RIN
Groningen Rijksuniversiteit (Netherlands). P
Lab.
For primary bibliographic entry see Field 07B
W69-09450

SEPARATION OF RAINFALL EXCESS F TOTAL RAINFALL,
Washington State Univ., Pullman.
David R. Scully, and Donald L. Bender.
Water Resources Res, Vol 5, No 4, p 877-883
1969. 7 p, 5 fig, 1 tab, 10 ref.

Descriptors: *Rainfall-runoff relation
*Precipitation excess, Rainfall disposition, H
graph analysis, Infiltration, Water storage, Su
groundwater relationships, Vegetation e
Overland flow.
Identifiers: Rainfall excess calculation.

Twenty-seven unit hydrographys from the R
Creek basin in Iowa were used to develop a g
dimensionless unit hydrograph. A dimensi
unit hydrograph procedure is used with excess
fall rates to synthesize historic hydrographs o
ston Creek. The distribution of the excess r
for 5-minute intervals is obtained when the
puted storm hydrograph compares favorably
the historic storm hydrograph. Infiltration loss
are obtained by separating excess rainfall
from total rainfall. Infiltration loss rates are
to vary directly with the rainfall intensity and
practically independent of time. It is suggeste
surface detention is responsible for the incre
infiltration loss rates during heavy bursts of ra
Most water in surface detention is slowly re
to direct runoff from its temporary storage
the rainfall moderates or stops. (Knapp-USGS
W69-09469

INFERENCE OF STRATOSPHERIC TEMP TURE AND MOISTURE PROFILES FRON SERVATIONS OF THE INFRARED HORIZ
GCA Corp., Bedford, Mass.
F. B. House, and G. Ohring.
NASA, Langley Res Center Contract Rep Cr-
Aug 1969. 58 p, 19 fig, 8 tab, 10 ref, 1 append

Descriptors: *Infrared radiation, *Atmosp
physics, *Remote sensing, *Moisture availa
*Research facilities, Temperature, Pressure,
vapor, Clouds, Instrumentation, Method
Thermodynamic behavior, Design data, Stat
methods, Optical properties, Altitude, Sat
(Artificial).
Identifiers: *Atmospheric structure, *Data
sis, Instant inversion technique, Stratosphere.

This report presents results of theoretical res
performed for the Langley Research Cente
concerns the feasibility of inferring atmosp
temperature and moisture profiles from h
radiances in the 15 micron carbon dioxide
and the water rotational band. Description
given of investigations performed concernit
version techniques, absorption band struc
error analyses, and problems related to instr
design. The instant inversion techniq
developed and applied sucessfully to both the
cal radiance profiles and observed horizon
ances from Project Scanner. Analysis of the
version results leads to a recommended me
ment and data reduction technique for deter
tion of temperature and moisture profiles i
stratosphere and lower mesosphere. Useful
peratures can be obtained at altitude range

o 65 km and water vapor mixing ratios within 10 to 50 altitude range. (Lang-USGS)
9-09659

RELIMINARY REPORT ON AN EMPIRI- ANALYSIS OF DRAINAGE NETWORK JUSTMENT TO PRECIPITATION INPUT,
o Univ., Moscow.
primary bibliographic entry see Field 02A.
9-09671

. Snow, Ice, and Frost

TER MOVEMENT AND FREEZING PRES-ES,
y Terrestrial Sciences Center, Hanover, N.H.
h Sciences Branch.
primary bibliographic entry see Field 02G.
9-09480

ORLY DRAINED SOILS WITH PER-FROST IN INTERIOR ALASKA,
y Terrestrial Sciences Center, Hanover, N.H.; Dartmouth Coll., Hanover, N. H. Dept. of h Sciences.
primary bibliographic entry see Field 02G.
9-09486

E EFFECT OF CHINOOK (FOEHN) ON SUR-CE ABLATION OF ALIBEK GLACIER (RUS-N),
rkov State Univ. (USSR).
. Serbura.
rkov Univ, Vestnik Geol i Geogr, Ser No 25, 2, p 104-105, 1967. 2 p, 1 tab, 4 ref.

criptors: *Glaciers, *Ablation, *Chinook, nds, Dry seasons, Atmospheric pressure, Air ulation, Anticyclones, Summer, Spring, Tem-ature, Humidity, Radiation, Snowmelt, Al-de.
ntifiers: *USSR, *Foehn ablation.

effect of dry warm winds, the foehn, on surface tion of glaciers is described on the basis of data ected in 1957 and 1958. Data were recorded on night ice melt conditions at an altitude of 5m. Maximum ablation effect was observed at temperature of 10-12 deg C and humidity ex-ding 30%. The ablation effect is decreased with ncrease of temperature. (Gabriel-USGS)
9-09515

OWTH MODE OF ICE CRYSTALS IN AIR LOW PRESSURE,
oya Univ. (Japan). Water Research Lab.
ji Isono, and Kunimoto Iwai.
ure, Vol 223, No 5211, p 1149-1150, Sept 13, 9. 2 p, 3 fig, 5 ref.

criptors: *Ice, *Crystal growth, *Cloud physics, limation, Water properties, Laboratory tests, stals, Freezing, Condensation, Nucleation, nperature, Pressure, Humidity.
ntifiers: *Ice clouds, Noctilucent clouds, Nacre-clouds.

n study of the formation of noctilucent and reous clouds, ice crystals were grown on a metal ace in a vacuum cryostat. The cryostat was ntained at pressures from 0.1 to 0.000001 mm Hg. At pressures lower than 0.1 mm, crystals w in spherically symmetric, transparent, specu-form. Neither edge growth nor skeleton struc-s were observed. Air bubbles were not in-led. With fixed values of supersaturation and perature, radius increase was linear. At tem-tures between -50 deg C and -80 deg C, values ne sublimation coefficient were about 0.06, and ow 80 deg C the value increased with decreasing perature. At pressures as low as .01 to .001 , ice particles are roughly spherical; needle-ped crystals can apparently be grown only on dle-shaped nuclei. It is concluded that ice crystal growth in mesospheric and high-stratospheric conditions differs from growth in tropospheric conditions. This should be taken into account in the study of noctilucent and nacreous clouds. (Knapp-USGS)
W69-09651

EFFECT OF ICE CONCENTRATION ON THE SEA SURFACE TEMPERATURE,
Arkticheskii i Antarkticheskii Nauchno-Issledovatelskii Institut, Leningrad (USSR).
A. S. Denisov.
Transl by Scripta-Technica from Okeanologiya, Akad Nauk, SSR, Vol 8, No 4. Oceanology, Vol 8, No 4, p 473-476, 1968. 4 p, 1 fig, 4 tab, 1 ref.

Descriptors: *Water temperature, *Ice loads, *Statistical methods, Regression analysis, Correlation analysis, Sea ice, Seawater, Arctic.
Identifiers: *Ice concentration in sea, *Temperature forecasting, Arctic Sea.

Statistical relationships between surface water temperature and ice concentration were obtained in one of the Arctic Seas. As a general rule the greater the ice concentration, the lower the surface water temperature. Preliminary analysis of the data revealed regional differences in temperature for the same ice coverage which was greater from north to south than from east to west. Further, regression equations showed that the absolute effects of ice in determining the water temperature decreased from July to September. The decrease was particularly rapid at the beginning of the cooling period. The correlation coefficients for August and September were 0.40 and 0.32 respectively. This would indicate that other factors may be important in determining the relationships between surface water temperature and ice concentrations. These studies are important in developing charts of mean water temperature and in temperature forecasting necessary in navigation. (Carstea-USGS)
W69-09701

ROLE OF SOIL MOISUTRE IN THE HYDROLOGICAL CYCLE,
Ontario Agricultural Coll., Guelph. School of Agricultural Engineering.
For primary bibliographic entry see Field 02G.
W69-09705

2D. Evaporation and Transpiration

GENERATION OF AN EVAPORATION TIME SERIES FOR LAKE ONTARIO,
Cornell Univ., Ithaca, N.Y.
Shaw Lei Yu, and Wilfried Brutsaert.
Water Resources Res, Vol 5, No 4, p 785-796, Aug 1969. 12 p, 3 fig, 4 tab, 26 ref. OWRR Project A-009-NY.

Descriptors: *Evaporation, *Time series analysis, *Mass transfer, Hydrologic data, Statistical models, Hydrologic budget, Climatic data, Climatology, Lake Ontario.
Identifiers: Evaporation time series.

Monthly mean values of evaporation from Lake Ontario for the period from 1872 to 1965 inclusive were generated by a mass transfer procedure. Available onshore recorded meteorologic data were adjusted to obtain approximate over lake values with empirically derived equations. The mass transfer coefficient was calculated by using an equation proposed by Harbeck relating the coefficient with water surface area. A comparison of the generated mass transfer evaporation data with water budget estimates obtained by Morton revealed that on the average the 2 methods gave similar results. (Knapp-USGS)
W69-09461

EVAPORATION FROM A SIMULATED SOIL SHRINKAGE CRACK,
Agricultural Research Service, Temple, Tex. Soil and Water Conservation Research Div.; and Agricultural Research Service, Big Spring, Tex. Soil and Water Conservation Research Div.
John E. Adams, Joe T. Ritchie, Earl Burnett, and D. W. Fryrear.
Soil Sci Soc Amer Proc, Vol 33, No 4, p 609-613, July-Aug 1969. 5 p, 4 fig, 2 tab, 6 ref.

Descriptors: *Evaporation, *Soil moisture, *Cracks, *Shrinkage, *Laboratory tests, Model studies, Winds, Evaporation control, Mulching, Water conservation, Soil management, Water management (Applied).
Identifiers: Soil shrinkage cracks.

A simulated soil shrinkage crack, 46 cm wide and 62 cm deep, was constructed in such a manner that depth could be varied by 15.2-cm increments and width could be adjusted between 10 and 70 mm by 20-mm intervals. The walls of the crack were lined with porous ceramic plates connected to a water supply maintained at -5 mb potential. The simulated crack was installed in the floor of a laboratory wind tunnel located in a controlled environment room maintained at 24.0 C air temperature and 43% relative humidity. Evaporation from the simulated crack walls (ceramic plates) was determined for all combinations of four crack widths (10, 30, 50, and 70 mm), three crack depths (30, 45, and 60 cm) and five windspeeds (0, 2.2, 4.5, 6.7, and 8.9 m sec). Total water loss (evaporation) from the walls of the simulated crack increased as any one or all of the three variables (windspeed, crack depth, or crack width) increased. These three variables accounted for 99.1% of the variability in total evaporation from the crack walls. Turbulent air movement within the simulated crack was the major factor affecting the evaporation. Both straw and gravel mulches reduced evaporation from the crack walls 85 to 90% with no wind and about 60% at 8.9 m per sec windspeed. The results suggest that evaporation from soil shrinkage cracks may be reduced by closer plant or row spacing or by surface residues such as trash and clod mulches. Total evaporation from a simulated crack 60 cm deep varied from 0.5 cm per hr (10 mm wide, 0 m per sec windspeed) to 18 cu m per hr (70 mm wide, 8.9 m per sec windspeed). In simulated cracks 60 cm deep and 30-70 mm wide, 50-60% of the total evaporation occurred below 15 cm and 30-40% occurred below 30 cm. (Knapp-USGS)
W69-09488

EVAPOTRANSPIRATION FROM TWO PEAT-LAND WATERSHEDS,
Forest Service (USDA), Grand Rapids, Minn. North Central Experiment Station.
Roger R. Bay.
Int Ass Sci Hydrol Pub No 78, Gen Assembly of Bern, Sept-Oct 1967, p 300-306, 1967. 7 p, 1 fig, 4 tab, 14 ref.

Descriptors: *Evapotranspiration, *Bogs, *Water balance, *Swamps, *Peat, Evaporation, Transpiration, Water table, Water level fluctuations, Saturated soils, Streamflow, Consumptive use, Minnesota.
Identifiers: *Peatlands, Spruce forests, Potential evapotranspiration.

Measurements of precipitation, runoff, and bog water table levels have provided data for the calculation of evapotranspiration from two forested peatland watersheds near Grand Rapids, Minnesota (ca. 47 deg 31 min N, 93 deg 28 min W). Continuous hydrologic records were collected on one experimental bog for 6 years (1961-1966) and on the other for the past 2 years (1965-1966). Water level changes in each bog were converted to inches-depth of storage by water yield coefficients for specific peat horizons and used to adjust precipitation-runoff calculations. Evapotranspiration estimates for the growing-season period May 1 to November 1 ranged from 87 to 121 percent of potential evapotranspiration computed by the

Thornthwaite method. Midsummer evapotranspiration totals (June 1 to September 1) were 70 to 99 percent of potential evapotranspiration. Mean daily evapotranspiration values from both bogs during short summer drying periods were consistently less than the calculated potential values.
W69-09572

POTENTIAL EVAPOTRANSPIRATION AND CLIMATE IN ALASKA BY THORNTHWAITE'S CLASSIFICATION,
Pacific Northwest Forest and Range Experiment Station, Juneau, Alaska. Inst. of Nothern Forestry; and State Univ., of New York, Syracuse. Dept. of Watershed Management.
James H. Patric, and Peter E. Black.
US Forest Serv Res Pap PNW-71, 1968. 28 p, 4 fig, 2 tab, 19 ref.

Descriptors: *Evapotranspiration, *Alaska, Water balance, Hydrologic budget, Humidity, Climates, Temperature, Cold regions, Data collections, Climatic data.
Identifiers: *Thornthwaite method.

Estimates and measurements of potential evapotranspiration in Alaska by Thornthwaite's methods showed good agreement with estimates and measurements by other methods. Natural vegetation is closely related to climate. Vegetation distribution in the interior seems governed more by temperature than by moisture availability. The available data heavily bias classifications of climate to sea-level and valley-bottom conditions. (Knapp-USGS)
W69-09698

A METHOD OF ESTIMATING STREAMFLOW LOSS BY EVAPOTRANSPIRATION FROM THE RIPARIAN ZONE,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
Irvin C. Reigner.
Forest Science, Vol 12, No 2, June 1966.

Descriptors: *Evapotranspiration, *Riparian water loss, *Watersheds (Basins), Diurnal distribution, Streamflow forecasting, Hydrograph analysis, Base flow, Low flow, Surface-groundwater relationships, Estimating equations, Pennsylvania.
Identifiers: *Experimental watersheds, Hydrologic analysis.

Conservative values of daily streamflow loss by evapotranspiration from the riparian zone were obtained by hydrograph analysis. The two highest peaks of a series of diurnal fluctuations were connected by a straight line, representing the potential groundwater flow for a series of days between storm flows. The series should ideally be no longer than 5 days. After sufficient number of daily riparian water losses were obtained, they were used as observations for the dependent variable in multiple-regression analysis. In this investigation, 62 samples, occurring during June, July, and August in 1955 and 1956, were used. An estimating equation was derived, using as predictor variables: (1) the one-half powers of mean daily streamflow in c.f.s., and (2) the one-half powers of weighted vapor-pressure deficit. The two individual variables were subsequently eliminated by their product interaction. The equation estimated riparian water loss with a relatively high degree of accuracy; 76 percent of the total variation was removed by the single complex variable.
W69-09760

2E. Streamflow and Runoff

ON THE RANDOM OCCURRENCE OF MAJOR FLOODS,
Geological Survey, Arlington, Va.
For primary bibliographic entry see Field 06A.
W69-09460

CLOGGING IN SURFACE SPREADING OPERATIONS FOR ARTIFICIAL GROUNDWATER RECHARGE,
Agricultural Research Service, Fresno, Calif. Groundwater Recharge Field Station.
For primary bibliographic entry see Field 04B.
W69-09468

A NOTE ON MORAN'S PROBABILITY THEORY OF DAMS AND STORAGE SYSTEMS,
City Univ., London (England).
For primary bibliographic entry see Field 04A.
W69-09470

A COMBINED CONTROL-METERING SECTION FOR GAGING LARGE STREAMS,
Forest Service (USDA), Flagstaff, Ariz. Rocky Mountain Forest Range Experiment Station.
For primary bibliographic entry see Field 07B.
W69-09471

SOME EFFECTS OF MAN-MADE CONTROLS IN THE UPPER REACHES OF A SMALL DRAINAGE BASIN,
Mississippi State Univ., State College. Dept. of Civil Engineering; and Mississippi State Univ., State College. Water Resources Research Inst.
For primary bibliographic entry see Field 04A.
W69-09491

FLOOD PLAIN INFORMATION, EAST FORK WHITE RIVER AND TRIBUTARIES, VICINITY OF COLUMBUS, INDIANA.
Corps of Engineers, Louisville, Ky.
For primary bibliographic entry see Field 04A.
W69-09496

FLOOD PLAIN INFORMATION-COASTAL FLOODING AT HAMPTON, VIRGINIA.
Corps of Engineers, Norfolk, Va.
For primary bibliographic entry see Field 04A.
W69-09497

INVESTIGATIONS OF SURFACE AND GROUNDWATER RUNOFF (RUSSIAN),
M. F. Skribnyy, V. T. Turchinovich, I. A. Kuznetsov, G. P. Yunusov, and N. N. Favorin.
Moscow, Akad Nauk, 1967. 187 p.

Descriptors: *Surface runoff, *Groundwater movement, Floods, Water resources, Mathematical studies, Water balance, Economics, Agriculture, Agricultural engineering, Discharge (Water), Watersheds (Basins), Seawater, Filtration, Rain, Snow, Mudflows, Obstruction to flow, Monsoons.
Identifiers: *USSR, Groundwater runoff.

A collection is presented of 13 articles on groundwater and surface runoffs on the basis of analytical and experimental studies conducted by USSR investigators. The collection contains the following articles: (1) Physicotechnical problems for mastering water resources, by M. F. Skribnyy; (2) a method of working out a water economy balance, by V. T. Turchinovich; (3) the meaning of water-economy balance in rational utilization of water resources, by I. A. Kuznetsov; (4) stability of normal annual runoffs and seasonal river discharges under conditions of the development of agrotechnical measures in the watershed, by G. P. Yunusov; (5) groundwater regime change as a method of preventing seawater incursion, by N. N. Favorin; (6) analysis of flood processes in watersheds characterized by filtration phenomenon, by M. F. Skribnyy; (7) generalized expression for a connection between the kinematic and morphologic elements of stream flow, by G. V. Zheleznyakov; (8) analysis of rainflood development in small basins, by I. L. Zimont; (9) calculation of maximum water discharges of rain and snow originally G. V. Zheloznyakov and B. B. Danilevich; (10) mud flows in the Transilian Ala. Tau and mud-flow catastrophe in the Issyk river of 7 July, 1963, by G. D. Rozhdestvenskiy; (11) some means for f flow prevention, by I. I. Mechitov; (12) Zerav river obstruction of 24 April, 1964, by G. D. R destvenskiy; and (13) analytical method of cal tion of Monsoon floods, by M. F. Skri (Gabriel-USGS)
W69-09511

AERIAL PHOTOGRAPHS FOR OPERATIO STREAMFLOW FORECASTING IN COLORADO ROCKIES,
Forest Service, Fort Collins, Colo.
For primary bibliographic entry see Field 07B.
W69-09539

A 2-YEAR EVALUATION OF THE SNOWM LYSIMETER,
Forest Service (USDA), Moscow, Idaho.
For primary bibliographic entry see Field 07B.
W69-09545

CHARACTERISTIC RESPONSE TIMES DESIGN FLOOD ESTIMATION,
New South Wales Univ., Kensington (Austr and Ministry of Public Works (Cambodia).
Federick C. Bell, and Songthara Om Kar.
J Hydrol, Vol 8, No 2, p 173-196, June 1969. 8 fig, 6 tab, 21 ref.

Descriptors: *Rainfall-runoff relationships, *F forecasting, *Design flood, *Routing, Stream forecasting, Water management (Applied), Hy graphs, Unit hydrographs, Hydrograph ana Mathematical models, Estimating.
Identifiers: Watershed response time.

In design flood estimation, characteristic resp times are required for the determination of h graph parameters and critical durations of f producing rainfall. Dimensionless hydrograph useful for design purposes and it appears that of these may be approximated by a single, si mathematical equation expressed in terms o rise time or time to peak. The rise time, tir concentration, lag, time to equilibrium, volume/peak ratio have been suggested as propriate characteristic times. These shoul governed mainly by the physical configuratio the catchments concerned but some are evid also affected significantly by the storm types durations and intensities of rainfall. The critic is suggested as a convenient characteristic time may be related to each of the other characte times. Under most circumstances the critical a suitable value for the critical duration of d rainfall. Several equations for estimating ch teristic times from catchment parameters presented but none of these is completely sati tory. (Knapp-USGS)
W69-09667

HYDROLOGIC RESEARCH FOR WATERS ENGINEERING,
Agricultural Research Service, Beltsville, Hydrograph Lab.
For primary bibliographic entry see Field 04D.
W69-09669

A PREFABRICATED FLAT-VEE WEIR EXPERIMENTAL CATCHMENTS,
Durham Univ. (England). Dept. of Geography
For primary bibliographic entry see Field 07B.
W69-09670

INDIANA AGRICULTURAL IRRIGATIO 1967,
Indiana Dept. of Natur Resources, Indiana Water Planning Section, and Purdue U Lafayette, Ind. Agriculture Extension Service.
For primary bibliographic entry see Field 03F.
W69-09680

TENT AND FREQUENCY OF FLOODS IN PPER MILLSTONE RIVER BASIN IN THE CINITY OF HIGHTSTOWN, N.J.,
ological Survey, Trenton, N.J.
orge M. Farlekas.
ol Surv Open-file Rep, Feb 1969. 57 p, 25 fig, 1 te, 5 tab, 20 ref.

scriptors: *Floods, *New Jersey, *Flood plains, scharge (Water), Stage-discharge relations, Sur-ce waters, Streamflow, Hydrographs, Profiles, ta collections, Hydrologic data.
ntifiers: Hightstown (NJ), Millstone River.

ooding of the Upper Millstone River basin near ghtstown, New Jersey is described. Data are sented on the extent, depth, and frequency of oding. Extent of flooding is shown by maps, ofiles, and cross sections. (Knapp-USGS)
69-09682

YDROLOGIC SIGNIFICANCE OF 1966 LOOD LEVELS AT LAKE JACKSON NEAR ALLAHASSEE, FLORIDA,
ological Survey, Washington, D.C.
lbert H. Hughes.
ol Surv Hydrol Invest Atlas HA-369, 1 sheet, 69. Text, 9 fig, 1 map, 3 tab, 4 ref.

scriptors: *Water levels, *Lakes, *Florida, ydrologic budget, Rainfall, Floods, Hydrographs, drogeology, Aquifers, Groundwater movement.
ntifiers: Lake Jackson (Tallahassee, Fla).

1966, the water level of Lake Jackson, Tallahas-e, Florida, reached its highest level since 1886. e lake is supplied with water only by direct rain-l and local runoff, and loses water by evapora-n and leakage to an underlying confined estone aquifer which always has a head lower an lake level. Recurrence intervals of lake stages re established by dating the killing of oak trees inundation of their roots. Hydrographs show arly rainfall, runoff of nearby rivers, and lake ages. (Knapp-USGS)
69-09688

LOODS ALONG LITTLE CALUMET RIVER ND TRIBUTARIES, ILLINOIS AND INDIANA.
rps of Engineers, Chicago, Ill.
r primary bibliographic entry see Field 04A.
69-09689

N OBJECTIVE APPROACH TO DEFINITIONS ND INVESTIGATIONS OF CONTINENTAL YDROLOGIC DROUGHTS,
lorado State Univ., Fort Collins. Dept. of Civil ngineering.
ujica M. Yevjevich.
lo State Univ Hydrol Pap No 23, Aug 1967. 19 9 fig, 1 tab, 12 ref.

escriptors: *Droughts, *Forecasting, *Statistical ethods, Stochastic processes, Precipitation (At-ospheric), Time series analysis, Regression analy-s, Monto Carlo method, Mathematical models, noptic analysis.
entifiers: Statistical runs, Continental droughts.

ethods are outlined for an objective definition of rge continental droughts. The phenomenon termining drought, the variable which properly scribes this phenomenon, the moisture level at hich a drought starts, and the area to which a ought is related are defined. Runs as statistical operties of time and space distribution of water ficits are recommended as parameters for ought definition. Run-length of negative devia-ns of a time series (duration of drought) run-sum negative deviations between a downcross and an ocross of a time series (severity of a drought) and ea-run as the deficit of water over a time duration un-length), and area drought are proposed as finitions of droughts. The runs can be deter-ined either analytically for simple cases or by the onte Carlo Method for more complex cases. Examples for these 2 methods are given. A review is made of results obtained at Colorado State University in the last 4 to 5 yr on the properties of precipitation, effective precipitation and runoff which affect the description of droughts and the outlook for drought prediction. An approach is proposed for prediction of large continental droughts by the search for an interrelationship of oceanic synoptic situation and continental precipitation. Some measures are explored which offer a possibility for combating large droughts. (K-napp-USGS)
W69-09704

WATER RESOURCES OF PULASKI AND SALINE COUNTIES, ARKANSAS,
Geological Survey, Washington, D.C.
Raymond O. Plebuch, and Marion S. Hines.
Geol Surv Water-Supply Pap 1839-B, p B1-B25, 1967. 25 p, 2 fig, 1 plate, 5 tab, 27 ref.

Descriptors: *Water resources, *Arkansas, Groundwater, Surface waters, Streamflow, Rivers, Reservoirs, Water yield, Water wells, Water quality, Aquifers, Hydrogeology, Hydrologic data, Data collections.
Identifiers: Pulaski County (Ark), Saline County (Ark).

Pulaski and Saline Counties constitute an area of 1,506 sq mi in the geographic center of Arkansas. The area is divided into a hilly western part, known as the Interior Highlands, and a relatively flat eastern part, known as the Coastal Plain. In the Interior Highlands, surface water offers greater possibilities than groundwater for water supplies. Alum Fork, Middle Fork, and North Fork of the Saline River offer excellent impoundment possibilities and will yield water of good quality. In addition, with storage, many of the smaller streams are suitable for development of small supplies. In contrast, in the Coastal Plain it is easier to develop groundwater than surface water in relatively large quantities. Two aquifers, units 3 and 9, yield as much as 350 and 2,000 gpm of water, respectively. A third aquifer, unit 7, is as yet relatively undeveloped in the project area, but yields 860 gpm to a well south of the project area. These aquifers yield water that, with treatment, is suitable for most uses. (Knapp-USGS)
W69-09711

ACCURACY OF DISCHARGE DETERMINATIONS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
W. T. Dickinson.
Colo State Univ Hydrol Pap No 20, June 1967. 54 p, 11 fig, 17 tab, 122 ref. 14-06-D-6007 (Bur Reclam).

Descriptors: *Discharge measurement, *Streamflow, *Discharge (Water), *Reviews, *Bibliographies, Mathematical studies, Statistical methods, Calibrations, Stage-discharge relations, Correlation analysis.
Identifiers: Rating curves.

Errors that may be incurred in discharge determinations made on mountain streams were analyzed. The possible sources of error were carefully considered, and a classification of these sources, including notations on the nature of the resulting errors, was prepared. A mathematical error model for a single discharge measurement was hypothesized, and methodology presented for the evaluation of daily, monthly, and annual discharge estimates. An exhaustive literature review was made. Each component was analyzed separately, and with respect to the others, in order to yield information about the random or systematic nature of the error, and about possible functional relationships which might be involved. This information has been summarized in the form of a classification of errors. A hypothetical error model was developed for a single discharge measurement to reveal the manner of combination of the various component errors, and to clarify the nature of some of the errors. Finally, consideration was given to the errors arising from use of an estimated rating curve, which accounts for virtually all the variability in sample data for 9 mountain stream-gaging stations in Colorado. Rating curves can be separated into two portions, one along which the relative error was virtually constant, and the other along which the absolute error remained constant. Confidence and tolerance limits were established for the estimated curves, and are used for inferences regarding the error bounds on daily discharge estimates and future discharge measurements. (K-napp-USGS)
W69-09713

ENGINEERING JUDGMENT AND SMALL AREA FLOOD PEAKS,
Colorado State Univ., Fort Collins.
Lourens A. V. Hiemstra, and Brian M. Reich.
Colo State Univ Hydrol Pap No 19, Apr 1967. 29 p, 11 fig, 9 tab, 25 ref. Bureau of Reclamation Contract 14-11-0008-0590-62.

Descriptors: *Flood forecasting, *Reviews, *Rainfall-runoff relationships, *Streamflow forecasting, *Runoff forecasting, Rational formula, Small watersheds, Rainfall intensity, Routing, Estimating.
Identifiers: Flood records.

The knowledge of small basin floods and the state of the art of flood predictions on ungaged basins are such that engineering judgement still plays an important role in the determination of a design flood. An appraisal of the reliability of 5 current methods of flood prediction is presented as an aid in developing this faculty. Flood estimates obtained by applying rainstorms estimated to have return periods of from 2- through 200-years were compared. For each of 6 such levels applied to 14 real basins, inconsistencies among 5 methods produced differences in the magnitude of their estimates as great as 300%. Since long flood records for small basins were inadequate, it was necessary to insert observed rainfalls into formulae and design methods. Design estimates based upon recorded rainstorms were compared to 134 observed floods, on 45 mixed-cover agricultural basins ranging in area from 0.12 through 8.16 sq mi. Scatter-diagrams, histograms, and statistics suggest some superiority of the 'Rational' formula, the Bureau of Public Roads method, and the Tacitly Maximized Peak technique in that they generally overestimate floods from this sample. Although variability is less than that of the other 2 methods, underprediction is possible in about a third of the cases. (Knapp-USGS)
W69-09714

UNSTEADY FLOW SIMULATION IN RIVERS AND RESERVOIRS,
Tennessee Valley Authority, Knoxville.
For primary bibliographic entry see Field 07C.
W69-09725

DIGITAL COMPUTER SIMULATION OF TRANSIENT FLOWS IN THE TVA SYSTEM,
Tennessee Valley Authority, Knoxville.
For primary bibliographic entry see Field 08B.
W69-09726

QUALITY OF SURFACE WATER IN ILLINOIS, 1956-1966,
Illinois State Water Survey, Urbana. Water Supply Div.
Robert H. Harmeson, and T. E. Larson.
Ill State Water Survey, Urbana, Bull 54, 1969. 184 p, 15 ref.

Descriptors: Alkalinity, Fluoride, *Illinois streams, Manganese, Mineral quality, Nitrate, Phosphate, Radioactivity, Surface water, Temperature, *Total dissolved minerals, Total hardness, Turbidity, *Water quality.

Surface water quality in Illinois has been determined by means of analysis of data from monthly water sampling programs. Sampling programs have spanned periods of approximately 5 years and have been carried on since 1945 for 61 locations on 45 streams and 1 lake. Data analyzed to show frequencies of median and extreme values of certain mineral constituents for specific streams and sampling periods provide base-line values for future water quality and water resource studies. Comparisons are drawn between water quality for the same stations in two or more sampling periods and also for streams or stations in different geographic or physiographic sections of the state. Attention is drawn to temporal changes in mineral constituents and to potential water quality problems.
W69-09739

2F. Groundwater

NUMERIC STUDIES OF A COMPOSITE SOIL MOISTURE GROUNDWATER SYSTEM,
Drexel Inst. of Tech., Philadelphia, Pa.
For primary bibliographic entry see Field 02G.
W69-09462

THEORY OF FLOW IN A CONFINED TWO AQUIFER SYSTEM,
California Univ, Berkeley.
Shlomo P. Neuman, and Paul A. Witherspoon.
Water Resources Res, Vol 5, No 4, p 803-816, Aug 1969. 14 p, 9 fig, 22 ref.

Descriptors: *Groundwater movement, *Aquifers, *Aquitards, *Mathematical models, Drawdown, Permeability, Leakage, Water levels, Withdrawal, Pumping, Water storage, Discharge (Water).
Identifiers: Leaky aquifers, 2-aquifer flow system.

A complete analytic solution has been developed for the problem of flow to a well in a confined infinite radial system composed of 2 aquifers that are separated by an aquitard. The well, which is represented by a line sink, completely penetrates only one of the aquifers and discharges at constant rate. The present solution differs from previous work in that the effects of storage in the aquitard and drawdown in the unpumped aquifer are both considered. Asymptotic solutions for small values of time are also included. The analytic solutions have been evaluated numerically for selected cases. The validity of these solutions has been verified independently using the finite element method of analysis. (Knapp-USGS)
W69-09463

APPLICABILITY OF CURRENT THEORIES OF FLOW IN LEAKY AQUIFERS,
California Univ., Berkeley.
Shlomo P. Neuman, and Paul A. Witherspoon.
Water Resources Res, Vol 5, No 4, p 817-829, Aug 1969. 13 p, 9 fig, 38 ref.

Descriptors: *Groundwater movement, *Aquifers, *Aquitards, *Leakage, *Mathematical models, Drawdown, Permeability, Water levels, Withdrawal, Pumping, Water storage, Discharge (Water), Analytical techniques.
Identifiers: *Leaky aquifer theory.

The applicability of current theories of flow in leaky aquifers has been investigated using new analytic and numeric solutions. In general it has been customary to use one or both of the following assumptions: (1) storage in the aquitards is negligible, and (2) drawdowns in the unpumped aquifers remain zero. At small values of time the first-assumption amounts to neglecting the effects of leakage completely. Errors introduced in this way can become significant when the Beta factor of Hantush exceeds 0.01. It appears that Beta may exceed 0.1 in many field situations. At large values of time, neglecting drawdowns in the unpumped aquifers can also lead to serious errors unless the transmissibilities of these aquifers are significantly greater than that of the pumped aquifer. In addition present methods of analyzing leaky aquifers usually rely only on drawdown data from the pumped aquifer. Such an approach is not sufficient to characterize a leaky system; current methods of analyzing field data from leaky aquifers need to be improved. (Knapp-USGS)
W69-09464

EFFECTS OF BOUNDARY CONDITIONS OF MODELS ON TRACER DISTRIBUTION IN-FLOW THROUGH POROUS MEDIUMS,
Weizmann Inst. of Science, Rehovoth (Israel).
N. D. Gershon, and A. Nir.
Water Resources Res, Vol 5, No 4, p 830-839, Aug 1969. 10 p, 3 fig, 1 tab, 21 ref.

Descriptors: *Groundwater movement, *Flow, *Porous media, *Tracers, Diffusion, Dispersion, Radioactivity effects, Chemical reactions, Mathematical models, Mathematical studies, Hydraulics, Steady flow, Unsteady flow, Distribution.
Identifiers: Tracer behavior in porous media.

Effects of initial and boundary conditions on the distribution of the tracer in time and distance are calculated for several one-dimensional systems (infinite, semi-infinite, and finite) of tagged liquid flowing through a solid matrix, and the effects of hydrodynamic dispersion, diffusion, radioactive decay, and simple chemical interactions of the tracer are included. Exact and approximative solutions show that in most practical conditions the results of steady state experiments are influenced only up to 0.5% by changes in boundary conditions. In nonsteady state, results are influenced up to 5% in the region where the ratio of the measured concentration and the concentration of the solution entering the porous medium is about 0.5. Results are given in non-dimensional form with graphs of representative cases. (Knapp-USGS)
W69-09465

DIFFUSION OF TRAPPED GAS FROM POROUS MEDIA,
Manitoba Univ., Winnepeg; Idaho Univ., Moscow; and Colorado State Univ., Fort Collins.
Kenneth M. Adam, George L. Bloomsburg, and Arthur T. Corey.
Water Resources Res, Vol 5, No 4, p 840-849, Aug 1969. 10 p, 8 fig, 2 tab, 7 ref.

Descriptors: *Flow, *Gases, *Liquids, *Porous media, *Wetting, Groundwater movement, Infiltration, Permeameters, Laboratory tests, Model studies, Hydraulic models, Unsaturated flow, Saturated flow, Diffusion, Porosity, Permeability.
Identifiers: Multiphase flow.

When a gas-filled porous medium is permitted to imbibe liquid from a source at a pressure equal to the initial gas pressure, some of the gas is trapped in the pores and is discontinuous with the atmosphere surrounding the medium. The amount of gas initially trapped varies over a range at least as wide as from about 5 to about 50% of the pore volume. The percentage of trapped gas is gradually reduced to zero as the gas diffuses away under the influence of capillary compression. This happens even though the imbibed liquid is presaturated with the gas initially trapped. Porous media become completely saturated with liquid first at exposed surfaces, and the zone of complete saturation moves continuously toward the interior. (Knapp-USGS)
W69-09466

DETERMINATION OF AQUIFER DIFFUSIVITY FROM AQUIFER RESPONSE TO FLUCTUATIONS IN RIVER STAGE,
Geological Survey, Washington, D.C.
George F. Pinder, John D. Bredehoeft, and Hilton H. Cooper, Jr.
Water Resources Res, Vol 5, No 4, p 850-855, Aug 1969. 6 p, 4 fig, 9 ref.

Descriptors: *Surface-groundwater relationships, *Induced infiltration, *Diffusivity, Hydrologic properties, Aquifers, Permeability, Stage-disch relations, Hydrograph analysis, Mathema models, Digital computers, Simulation analysis.
Identifiers: Aquifer diffusivity, Pumping t Aquifer tests.

The diffusivity of a homogeneous isotropic aqu can be determined from the response in the aqu to fluctuations in river stage. Observed change head in the aquifer are compared with theor head values computed assuming a series of fusivities. These values are generated by appr mating the stage hydrograph as a series of disc steps and summing the influence of each in ment. The diffusivity of the aquifer is calcul from the best-fitting theoretic response curve. fusivities computed for an aquifer at Musquodo Harbour, Nova Scotia, agree with values de mined from pumping test and digital model an sis. (Knapp-USGS)
W69-09467

CLOGGING IN SURFACE SPREADING OPE TIONS FOR ARTIFICIAL GROUNDWA RECHARGE,
Agricultural Research Service, Fresno, C Groundwater Recharge Field Station.
For primary bibliographic entry see Field 04B.
W69-09468

A CORRESPONDENCE PRINCIPLE FOR T THEORY OF LEAKY AQUIFERS,
Universidad Nacional Autonoma de Mexico, M ico City. Instituto de Geofisica.
Ismael Herrera, and German E. Figueroa.
Water Resources Res, Vol 5, No 4, p 900-904, 1969. 5 p, 1 fig, 5 ref.

Descriptors: *Groundwater movement, *Aquif *Aquitards, *Leakage, Water levels, Drawdo Pumping, Mathematical models, Water stor Water yield.
Identifiers: Leaky aquifer theory.

A correspondence principle for leaky aquifers which the storage in the confining layers is ta into consideration associates an imagin equivalent nonleaky aquifer with every le aquifer. It is valid for long periods of operati Using this principle, the study of the leaky aqui is reduced to the study of the corresponding n leaky aquifers. When the quality of the approxi tion is tested by applying it to an isolated w complete agreement with results obtained by o methods is found. The principle is suitable for plication to numeric studies of regional evolu of piezometric heads. (Knapp-USGS)
W69-09473

THERMAL AND ELECTRICAL CONDUCTI TIES OF SANDSTONE ROCKS AND OCE SEDIMENTS,
Oregon State Univ., Corvallis. Dept. of Ocean raphy; and National Academy of Sciences-Natio Research Council, Washington, D.C. Div. of Ea Sciences.
Jeremy R. Hutt, and Joseph W. Berg, Jr.
Geophysics, Vol 33, No 3, p 489-500, June 19 12 p, 4 fig, 3 tab, 17 ref, 3 append. Contract 1286 (10) ONR. Grant No GP 4642 NSF.

Descriptors: *Conductivity, *Thermal conduct ty, *Electrical conductance, *Electrical stud *Rocks, *Sediments, Hydraulic conductiv Permeability, Porosity, Sandstones, Mineralogy.
Identifiers: Thermal-electric conductivity relati ships.

Relationships between electrical and thermal c ductivities of consolidated sandstone rocks sediments were investigated. Equations given Archie and by Woodside and Messmer combi to give an equation which relates the 2 conduct ties for the rocks. Equations relating conducti and porosity, given by Maxwell, Bruggeman, Woodside and Messmer were combined to giv

ations which relate thermal and electrical con-
ctivities for sediments. Data from 65 rock sam-
s and 105 sediment samples were used in
ablishing the reliability and parameter values of
equations. The derived equation can be used to
ermine thermal conductivities from electrical
nductivities, providing thermal conductivities of
solid constituents can be approximated. For
nples of sandstone rock, deviations of the data
m values predicted by the equations are shown
e related to the variations in composition of the
nples. Within the accuracy of the data, the ther-
l conductivities of sediment samples seem to be
ntrolled more by the water content than by the
neral composition. (Knapp-USGS)
9-09498

**ANSIENT PRESSURE TESTING OF FRAC-
RED WATER INJECTION WELLS,**
n American Petroleum Corp., Tulsa, Okla.
K. Clark.
ns Soc Petrol Eng, Amer Inst Mining, Met, and
rol Eng, Inc, Vol 243, Part 1, p 639-643, 1968.
8 fig, 3 tab.

scriptors: *Rock mechanics, *Fractures (Geolo-
, *Injection wells, *Pressure, Mathematical
dels, Productivity, Water yield, Mathematical
dies, Model Studies, Permeability, Boreholes,
uifers, Carbonates, Filters, Parametric hydrolo-

ntifiers: Hydraulic fracturing, West Texas oil-
ducing area.

ause injection pressures in water injection wells
y create deeply penetrating fractures, a method
calculating fracture lengths from pressure fall-
test data was developed on the basis of analyti-
studies and experimental data recorded using
dels and the West Texas injection wells. The
thod is based on a linear flow model that stimu-
s conditions present during the early-time
iod after shutting in an injection well. Fracture
gth calculation procedure for pressure fall-off
data provides good estimates of true fracture
gth when applied to generated test data. Frac-
lengths calculated from field measured data
ear to be reasonable. (Gabriel-USGS)
9-09499

**PLACE DETERMINATION OF PERMEA-
ITY DISTRIBUTION FOR HETEROGENE-
S POROUS MEDIA THROUGH ANALYSIS
ENERGY DISSIPATION,**
telle Memorial Inst., Richland, Wash.
William Nelson.
ns Soc Petrol Eng, Amer Inst Mining, Met, and
rol Eng, Inc, Vol 243, Part 2, p 33-42, 1968. 10
fig, 8 ref.

criptors: *Porous media, *Permeability,
athematical studies, *Energy dissipation,
mputer programs, Heterogeneity, Saturated
, Streamflow, Fluid mechanics, Porosity,
ropy, Digital computers, Mapping.
ntifiers: Grand View (Idaho).

theoretical basis is presented for energy dis-
tion methods of measuring permeability in
rated heterogeneous media. Analysis starts
the equation for single-phase flow in
rogeneous porous media which is a first-order
ial differential equation in the unknown
neability. This equation is reduced to a system
haracteristic equations useful in deriving a dif-
ntial expression for the permeability as a func-
of the known potential distribution. For steady
systems the expression is integrable, giving the
neability integral for direct calculation of the
ribution along successive stream lines. The
ndary condition in permeability is presented
includes a discussion of the special require-
t to assure uniqueness. Theoretical results and
ssary computations are incorporated into two
eral computer programs capable of determining
permeability distribution in 2- and 3-dimen-
al steady flow systems. Results are then presented for an energy dissipation analysis using the methods and software to determine a field permeability thickness distribution. (Gabriel-USGS)
W69-09500

STEADY-STATE FLOW CAPACITY OF WELLS WITH LIMITED ENTRY TO FLOW,
Mobil Research and Development Corp., Dallas, Tex.
A. S. Odeh.
Trans Soc Petrol Eng, Amer Inst Mining, Met, and Petrol Eng, Inc, Vol 243, Part 2, p 43-51, 1968. 9 p, 10 fig, 3 tab, 8 ref, 1 append.

Descriptors: *Aquifers, *Steady flow, *Flow rates, *Water wells, *Flow characteristics, Mathematical studies, Computer programs, Computers, Water supply, Pressure, Boreholes, Water loss, Productivity, Drainage wells, Anistropy, Porous media.
Identifiers: Steady-state flow capacity of wells.

The effect of limited entry to flow at the borehole on the steady-state production of a well is analyzed on the basis of analytical studies of earlier publications and well data. The finite cosine transform was used to arrive at a solution for steady-state flow of a slightly-compressible flow and the solution was programmed for a digital computer. The correct calculation of skin and damage ratio in the presence of limited entry to flow is outlined and calculation of the net decrease in productivity due to the combined effect of limited entry and performations is explained. (Gabriel-USGS)
W69-09501

AREAL SWEEP EFFICIENCY OF PSEUDOPLASTIC FLUIDS IN A FIVE-SPOT HELE-SHAW MODEL,
Shell Development Co., Houston, Tex.
K. S. Lee, and E. L. Claridge.
Trans Soc Petrol Eng, Amer Inst Mining, Met, and Petrol Eng, Inc, Vol 243, Part 2, p 52-62, 1968. 11 p, 9 fig, 3 tab, 36 ref, append.

Descriptors: *Fluid mechanics, *Efficiencies, *Mathematical studies, *Model studies, *Groundwater movement, Velocity, Water circulation, Viscosity, Viscous flow, Oil, Oily water, Porous media, Isotropy, Saturated flow, Tension, Parametric hydrology.
Identifiers: Pseudoplastic fluids, Areal sweep efficiency.

Areal sweep efficiency of oil displacement by enhanced-viscosity water exhibiting pseudoplastic behavior was measured in a Hele-Shaw model representing one-quarter of a five-spot pattern. The pseudoplasticity of polymer solutions and the velocity distribution in the five-spot pattern produced a condition under which the mobility ratio between the displacing and the displaced fluid could not be assigned a single value. Instead, the movement of the displacement front is governed by local mobility ratios which are also time dependent. The areal sweep at breakthrough with polymer solutions was poorer than the sweep obtained with Newtonian fluids of comparable viscosity. However, the areal sweep a 1 PV throughput was greatly improved as compared to flood water without polymer. It was also demonstrated that, even after the oil-cut had declined to a low value during a regular waterflood, switching to polymer flood efficiently swept out the oil remaining in the model. (Gabriel-USGS)
W69-09502

TRANSIENT STRESSES AND DISPLACEMENT AROUND A WELLBORE DUE TO FLUID FLOW IN TRANSVERSELY ISOTROPIC, POROUS MEDIA: 1. INFINITE RESERVOIRS,
Texas Univ., Austin.
M. S. Seth, and K. E. Gray.
Trans Soc Petrol Eng, Amer Inst Mining, Met, and Petrol Eng, Inc, Vol 243, Part 2, p 63-78, 1968. 16 p, 11 fig, 1 tab, 25 ref.

Descriptors: *Stress analysis, *Porous media, *Fluid mechanics, *Water wells, *Groundwater movement, Mathematical studies, Aquifers, Thermal stress, Digital computers, Rocks, Physical properties, Rock properties, Strain, Boreholes, Flow rates, Pressure.
Identifiers: Fluid flow in porous media.

Equations of elasticity for transversely isotropic, axisymmetric, homogeneous, porous media with pore fluid pressure were developed by using an analogy between thermal and porous body stresses. Stress gradients are high near the borehole and die out away from the borehole. Anistropy considerably modifies the states of stress and strain. Radial stresses are compressive or neutral, whereas tangential stresses are tensile, neutral, or compressive, depending upon boundary conditions. In an unbounded system, the vertical stress is essentially proportional to the constant rate of fluid injection at the borehole and decreases with time, whereas the radial and tangential stresses increase with time. At a given location, the radial displacement gradient is dependent upon time. (Gabriel-USGS)
W69-09503

THRESHOLD PRESSURE PHENOMENA IN POROUS MEDIA,
Phillips Petroleum Co., Bartlesville, Okla.; and Michigan Univ., Ann Arbor.
L. K. Thomas.
Trans Soc Petrol Eng, Amer Inst Mining, Met, and Petrol Eng, Inc, Vol 243, Part 2, p 174-184, 1968. 11 p, 11 fig, 4 tab, 18 ref, append.

Descriptors: *Pressure, *Saturation, *Porous media, *Pressure measuring instruments, *Mathematical studies, Analytical techniques, Water, Gases, Permeability, Porosity, Surface tension, Water pressure, Aerial photography.
Identifiers: Underground gas storage, Threshold pressure, Bubbling pressure.

Threshold displacement pressures are needed to determine how much overpressure can be used in storing natural gas. An experimental technique for determining threshold pressures by displacing water with gas from samples saturated with water is presented. Threshold pressures for eight low permeability samples were measured. Threshold pressure data obtained in this work, plus data on higher permeability samples reported in the literature, are correlated with porosity, permeability, surface tension and formation resistivity factor. Mercury injection pressures also were measured and correlated with air-water threshold pressures. Threshold pressures were found to be independent of time. An aerial photograph of gas emerging from the top of a core shortly after its threshold pressure has been exceeded shows that the gas bubbles are uniformly distributed across the face of the core. Channeling will occur, however, when an increased gas phase permeability is reached. (Gabriel-USGS)
W69-09504

INVESTIGATIONS OF SURFACE AND GROUNDWATER RUNOFF (RUSSIAN),
For primary bibliographic entry see Field 02E.
W69-09511

METHODS FOR THE EVALUATION OF TOTAL WATER INFLOW INTO DEEP MINES (RUSSIAN),
Kharkov State Univ. (USSR).
G. G. Malevannyy.
Kharkov Univ, Vestnik Geol i Geogr, Ser No 25, No 2, p 66-68, 1967. 3 p, 1 fig, 2 tab.

Descriptors: *Aquifers, *Mathematical studies, *Inflow, Water sources, Water supply, Mineral industry, Coal mines, Hydrologic properties, Water circulation, Fissures (Geology), Shafts (Excavations).
Identifiers: *USSR, Coal mining inflow.

Inflows into Russian coal mines were investigated by assuming a mean coefficient of water supply for

a mean shaft depth and evaluating from the experimental data the coefficient of water supply for each coal horizon. In evaluating the total inflows, the coefficients of water supply were multiplied by the mean productivity of a coal mine. The total inflows were projected for a few coal mines for the years of 1970 and 1980. (Gabriel-USGS)
W69-09512

SOME CHARACTERISTICS OF HYDROLOGICAL STRUCTURES IN NEW OCCURRENCES OF CARBONACEOUS MINERAL SPRINGS IN THE NORTHERN CAUCASUS (RUSSIAN),
Kharkov State Univ. (USSR).
G. F. Kovalevskiy.
Kharkov Univ, Vestnik Geol i Geogr, Ser No 25, No 2, p 69-74, 1967. 6 p, 7 ref.

Descriptors: *Mineral water, *Spring waters, *Hydrologic properties, *Structures, Carbon dioxide, Geology, Sedimentary rocks, Igneous rocks, River basins, Boreholes, Water levels, Piezometry, Water analysis, Discharge measurement, Sulfates, Sodium, Calcium, Temperature, Fissures (Geology).
Identifiers: *USSR, *Northern caucasus, Carbonaceous mineral springs.

The article describes the hydrologic structure and chemical composition of mineral waters of the North Caucasus springs on the basis of boreholes and field geology data. The study shows that the new occurrences of mineral waters in the Kuma and Podkumok River basins are associated with the Jurassic rocks. The formation and distribution of these carbonaceous mineral waters are associated with the tectonic disturbances and the carbonaceous gas is of deep thermometric origin. The study also shows that the direction of the circulation of these carbonaceous mineral waters obeys the law of circulation of groundwaters in sedimentary rocks. (Gabriel-USGS)
W69-09513

GROUNDWATER AND VEGETATION IN TWO PEAT BOGS IN NORTHERN MINNESOTA,
Forest Service (USDA), Grand Rapids, Minn. North Central Forest Experiment Station.
Roger R. Bay.
Ecology, Vol 48, No 2, p 308-310, Spring, 1967. 3 p, 1 tab, 9 ref.

Descriptors: *Bogs, *Swamps, *Groundwater, *Vegetation, Aquifers, Hydrogeology, Water table, Perched water, Peat, Organic soils, Potholes, Forests, Marsh management, Water quality, Marsh plants, Acidity, Conductivity, Minnesota.
Identifiers: *Peatlands, *Groundwater bogs, *Perched bogs, Bog floristics, Specific conductivity.

Plant cover and water quality of bog waters were related to the surrounding groundwater flow systems in two experimental bogs in northern Minnesota. One bog was considered a perched bog because it was perched above and isolated from the regional groundwater system. The other bog, termed a groundwater bog, was being recharged by the regional flow system. Water in the perched bog ranged from a pH of 4.2 to 4.7, while in the groundwater bog pH ranged from 5.9 to 6.7. Conductivity (micromhos) was also considerably less in the perched bog, varying from 16 to 46, while specific conductivity in the groundwater bog ranged from 44 to 133. Because of the mineral-influenced bog waters, the groundwater bog had a much greater variety and abundance of plant cover, quite typical of the more fertile bog sites. This richness of vegetation was not found in any other perched bog.
W69-09569

HYDROGEOLOGICAL EQUATIONS FOR DETERMINING GROUNDWATER YIELDS IN THE DRAINAGE OF OPENCAST MINES AND LARGE BUILDING PITS (GERMAN),
Lothar Richter.
Z Angew Geol, Vol 14, No 9, p 465-470, Sept 1968. 6 p, 4 fig, 9 tab, 4 ref.

Descriptors: *Mathematical studies, *Groundwater, *Water yield, *Drainage engineering, *Mine drainage, Construction, Water level fluctuations, Hydrologic properties, Water resources, Filtration, Hydrogeology.
Identifiers: Groundwater yield equations.

This article gives a review of the equations pertaining to the water-level fluctuations and yields of aquifers with a free water surface. These equations can be applied for the calculation of hydrologic parameters present in executing large drainage works in general or in drainage of opencast mines. Considering the groundwater resources, both the settled and unsettled lowering processes can be determined by using these equations for the conditions of three-lowering-stage yields. (Gabriel-USGS)
W69-09648

AQUIFER BEHAVIOR WITH INJECTION,
Petrobras Co., and Texas A and M Univ., College Station.
For primary bibliographic entry see Field 04B.
W69-09650

TRANSIENT FUNCTIONS FOR LAND DRAINAGE,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
S. A. Jenab, A. A. Bishop, and Dean F. Peterson, Jr.
ASCE Proc, J Irrig and Drainage Div, Vol 95, No IR3, Pap 6768, p 361-373, Sept 1969. 13 p, 9 fig, 3 tab, 8 ref, append.

Descriptors: *Drainage, *Runoff, *Infiltration, *Overland flow, *Mathematical studies, Drainage effects, Drainage engineering, Drawdown, Diffusion, Transmissivity, Water storage, Recession curves, Discharge (Water).
Identifiers: Land Drainage.

Solution of the diffusion equation for a line sink in a plane yields the error function. By superposition and integration, functions which describe the transient position and rate of fall of a water table under artificial drainage are developed for multiple drains. These may be used to determine in situ values of transmissivity and storage as well as for discharge. A means of using the method for any initial water table position is presented and some design examples are given. (Knapp-USGS)
W69-09654

WELL CAPACITY FOR CONTINUOUS PERMEABILITY VARIATION,
Northwestern Univ., Evanston, Ill., Technological Inst.; and Soil Testing Espanola, Madrid.
For primary bibliographic entry see Field 08B.
W69-09656

QUICK-RETURN SUBSURFACE FLOW,
Agricultural Res Service, Beltsville, Md. Hydrograph Lab.; and Agricultural Research Service, Madison, Wis. Soil and Water Conservation Div.
For primary bibliographic entry see Field 02G.
W69-09665

GROUNDWATER FLOW IN THE NETHERLANDS DELTA AREA AND ITS INFLUENCE ON THE SALT BALANCE OF THE FUTURE LAKE ZEELAND,
Institute for Land and Water Management Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 02L.
W69-09666

AN INTERFACE PROBLEM WITH A SOURCE AND A SINK IN THE HEAVY FLUID,
Technische Hogeschool, Delft (Netherlands).
For primary bibliographic entry see Field 02L.
W69-09668

GROUNDWATER OCCURRENCE IN THE DENDALE AREA, KLICKITAT CO WASHINGTON,
Geological Survey, Washington, D.C.
J. E. Luzier.
Geol Surv Hydrol Invest Atlas HA-313, 1 1969. 8 fig, 1 map, 1 tab, 9 ref.

Descriptors: *Water resources, *Groundw *Washington, Water wells, Water quality, yield, Aquifers, Water levels, Hydroge Columbia River, Irrigation water, Municipal w Water supply.
Identifiers: Klickitat County (Wash).

Groundwater occurrence in the Goldendale a Klickitat County, Washington is shown by a 1- hydrological atlas consisting of a geohydr map scaled 1:6250, drillers logs of represent wells, water level graphs, a precipitation map hydrographs of springs and creeks. Selected records and chemical analyses are tabulated. groundwater in the area occurs in perm basalts. Most groundwater use is for domesti stock purposes. Springs are the chief sourc public supply, and surface waters are used f rigation. (Knapp-USGS)
W69-09685

RECONNAISSANCE OF THE GROUNDWA RESOURCES OF THE MISSOURI RIVER LUVIUM BETWEEN KANSAS CITY, MISS AND THE IOWA BORDER,
Geological Survey, Washington, D.C.
L. F. Emmett, and H. G. Jeffery.
Geol Surv Hydrol Invest Atlas HA-336, 1 1969. Text, 8 fig, 2 map, 3 tab, 18 ref.

Descriptors: *Water resources, *Mis *Nebraska, *Groundwater, Aquifers, Allu Missouri River, Water quality, Water Hydrogeology, Hydrologic data, Water l Permeability, Transmissivity.
Identifiers: Kansas City (Mo).

The groundwater resources of the Missouri alluvium between Kansas City and the Iowa b are described in a 1-sheet hydrological atlas ing the thickness, area, and lithology of the a um. Information is given on the occurrence, a bility, use, and chemical quality of the gr water. (Knapp-USGS)
W69-09686

GROUNDWATER APPRAISAL OF THE LI WABASH BASIN ABOVE THE GAGE BE CLAY CITY AND THE LOUISVILLE RE VOIR SITE, ILLINOIS,
Geological Survey, Washington, D.C.
Frank A. Watkins, Jr., and Dale J. Nyman.
US 90th Congr, 2nd Sess, Senate Doc No 96, V Append J, p 252-263, 1968. 12 p, 4 fig, 1 tab.

Descriptors: *Water resources development linois, Groundwater, Surface waters, Water qu Streamflow, Water pollution, Dams, Reser Aquifers, Glacial drift, Water levels, Water sto Hydrologic data, Data collections.
Identifiers: Wabash River Basin.

Moderate to large supplies of groundwate available from sand and gravel deposits in areas of the Little Wabash River basin, Illinoi are possible in other areas if the deposits are and areally extensive. Deoxygenation is a pro in the streams, during low-flow periods, from a the damsite downstream to at least the gage Clay City. At the gage below Clay City the tot solved solids are at times greater than 500 ppm to high sulfates or high chlorides or both. A d the Louisville site would help both these c tions. (Knapp-USGS)
W69-09693

ROUNDWATER APPRASIAL OF THE SKIL-ET FORK BASIN ABOVE WAYNE CITY AND ELM RESERVOIR SITE, ILLINOIS,
eological Survey, Washington, D.C.
rank A. Watkins, Jr.
S 90th Congr, 2nd Sess, Senate Doc No 96, Vol 2, ppend J, p 266-275, 1968. 10 p, 4 fig, 1 tab.

escriptors: *Water resources development, *Il-ois, Groundwater, Surface waters, Water quality, reamflow, Water pollution, Dams, Reservoirs, quifers, Water levels, Water storage, Hydrologic ta, Data collections.
entifiers: Wayne City (Ill), Wabash River basin.

oderate to large supplies of groundwater are not ailable in the Skillet Fork Basin above Wayne ty, Illinois because of the lack of natural subsur-ce storage and permeable aquifers. The only eans of obtaining water supplies with a sustained eld greater than 1.16 cfs, which represents the reamflow exceeded 90% of the time, is the con-ruction of a reservoir in the basin to store water d improve its quality. (Knapp-USGS)
69-09694

ROUNDWATER APPRAISAL OF THE BIG ALNUT CREEK BASIN ABOVE LITTLE ALNUT CREEK AND BIG WALNUT CREEK ESERVOIR SITE, INDIANA,
eological Survey, Washington, D.C.
rank A. Watkins, Jr.
S 90th Congr, 2nd Sess, Senate Doc 96, Vol 2, ppend J, p 278-288, 1968. 11 p, 4 fig, 1 tab.

escriptors: *Water resources development, *Indi-a, Groundwater, Surface waters, Water quality, reamflow, Dams, Reservoirs, Water loss, quifers, Water levels, Water storage, Reservoir akage, Hydrologic data, Data collections.
entifiers: Wabash River Basin.

oss of water from a proposed reservoir is possible here the channel of Big Walnut Creek, Indiana is t into bedrock in the pool area. During dry-eather periods the Creek loses water in this reach. ater supply is not a problem in the basin at the esent time but could become a problem in the reencastle area in a period of severe drought. (K-app-USGS)
69-09695

ROUNDWATER APPRAISAL OF THE BIG LUE RIVER BASIN AND BIG BLUE RESER-OIR SITE, INDIANA,
eological Survey, Washington, D.C.
ale J. Nyman, and Frank A. Watkins, Jr.
S 90th Congr, 2nd Sess, Senate Doc No 96, Vol 2, ppend J, p 290-301, 1968. 12 p, 4 fig, 1 tab.

escriptors: *Water resources development, *Indi-a, Groundwater, Surface waters, Streamflow, ater quality, Dams, Reservoirs, Aquifers, Glacial ift, Alluvium, Water levels, Water storage, ydrologic data, Data collections.
entifiers: Wabash River Basin.

he Big Blue River basin, Indiana has an average y-weather yield of 0.27 cfs, one of the highest elds of any river in the Wabash River basin. The ver gains water for the entire distance from its igin to its mouth near Edinburg; along the upper d lowermost reaches of the main stem the scharge often doubles between measuring sites. he smallest gain in discharge occurs in the reach rough the reservoir site. This small gain probably presents a reduction in groundwater discharge e to the relatively small volume of the alluvial quifer and the low permeability of the adjacent l. Also there may be a minor amount of infiltra-on to buried valleys underlying the middle and per portions of the reservoir site. There is no drock exposed in or adjacent to the proposed servoir. Water supply is not a problem in most of e basin at the present time. The water use is for rm, domestic, and small municipal and industrial pplies. Adequate supplies for these purposes are ailable almost anywhere in the basin from oundwater. (Knapp-USGS)
W69-09696

GROUNDWATER APPRAISAL OF THE FLATROCK RIVER BASIN AND DOWNEYVILLE RESERVOIR SITE, INDIANA,
Geological Survey, Washington, D.C.
Dale J. Nyman, and Frank A. Watkins, Jr.
US 90th Congr, 2nd Sess, Senate Doc No 96, Vol 2, Append J, p 304-314, 1968. 11 p, 4 fig, 1 tab.

Descriptors: *Water resources development, *Indiana, Groundwater, Surface waters, Water quality, Streamflow, Dams, Reservoirs, Aquifers, Limestones, Water levels, Water yield, Water storage, Reservoir leakage, Water loss, Hydrologic data, Data collections.
Identifiers: Wabash River Basin.

The main stem of the Flatrock River, Indiana gains water for the entire distance from its origin to its mouth at Columbus. The largest gains occurred in the vicinity of the Lewisville partial record station, the reservoir site, and a few miles north of Columbus. Nevertheless, loss of water from a proposed reservoir is possible where the Flatrock River is cut into bedrock in the pool area, and at the damsite where the proposed dam is underlain by a buried bedrock valley. The exposed bedrock in the reservoir area is an irregularly bedded and jointed dolomite which is probably more permeable than the underlying shales and carbonate rocks. Water supply is not a problem in most of the basin at the present time except at the city of Columbus. Water use in the basin is for farm, domestic, small municipal and industrial supplies. Adequate supplies for these purposes are available almost anywhere in the basin from groundwater. (Knapp-USGS)
W69-09697

SP LOG INTERPRETATION IN SHALY SANDS,
Koninklijke-Shell Exploratie en Produktie Laboratorium, Rijswijk (The Netherlands).
L. J. M. Smits.
Trans Soc Petrol Eng, Amer Inst Mining, Met, and Petroleum Eng, Inc, Vol 243, Part 2, p 123-136, 1968. 14 p, 9 fig, 3 tab, 18 ref.

Descriptors: *Electrical well logging, *Boreholes, *Sands, Rocks, Saline water, Saturation, Mathematical studies, Clays, Porosity, Cation exchange, Permeability, Electrochemistry, Diffusivity, Conductivity, Sodium, Membrane processes.
Identifiers: Spontaneous potential interpretation.

A theoretical equation is developed describing membrane potentials of shaly sands as a function of the cation-exchange capacity per unit pore volume of the rock and saturating water salinity. This equation is based on the same simple physical model as that employed earlier describing the electrical conductivity of shaly sands. Experiments conducted with NaCl solutions showed that the equation is obeyed, except in the case of saturated salt solutions where minor deviations were observed. A possible explanation is given for this discrepancy. As the clay content and the porosity of shales may vary appreciably, shale membrane potentials also vary. It was found that membrane potentials of shales can be calculated accurately with the aid of the same theory. Consequently, changes in membrane potentials can be accounted for by simple measurement of cation-exchange capacities per unit pore volume of both shales and shaly sands. Charts are given to facilitate interpretation of the electrochemical part of the SP in terms of cation-exchange capacities and the salinities of mud filtrate and formation water. (Gabriel-USGS)
W69-09699

WATER RESOURCES OF PULASKI AND SALINE COUNTIES, ARKANSAS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W69-09711

AVAILABILITY OF GROUNDWATER IN TEXAS COUNTY, OKLAHOMA,
Geological Survey, Washington, D.C.
P. R. Wood, and D. L. Hart, Jr.
Geol Surv Hydrol Invest Atlas HA-250, 3 sheets, 1967. 7 fig, 3 map, 1 tab.

Descriptors: *Water resources, *Oklahoma, *Groundwater, Water wells, Water levels, Aquifers, Water yield, Water quality, Irrigation water, Water supply, Hydrogeology, Hydrologic data, Water utilization, Water storage.
Identifiers: *Texas County (Okla).

A hydrologic atlas of 3 sheets shows a real distribution of principal geologic units that control occurrence and availability of groundwater, approximate depth to water, and chemical character of groundwater in Texas County, Oklahoma. Approximate thickness of unconsolidated deposits and saturated material, a generalized geologic section, areas favorable for irrigation development, and areas where groundwater levels measured in 1966 have changed significantly from 1938 are also mapped. Basic information are given on the geologic and hydrologic features that govern the general availability of groundwater. Information contained in the atlas may be useful in an analysis of problems involving irrigation and the development and management of groundwater supplies. (Knapp-USGS)
W69-09715

GROUNDWATER RESOURCES OF INDIA-PRESENT STATUS AND SUGGESTED LINES OF FUTURE INVESTIGATION,
Geological Survey of India.
G. C. Chaterji.
Bull Geol Surv of India, Ser B, No 16, 1967. 60 p, 3 plate, 1 tab, 82 ref.

Descriptors: *Water resources development, *Planning, *Hydrogeology, Hydrologic data, Data collections, Surveys, Water law, Water utilization, Irrigation, Water supply.
Identifiers: *India.

The present status of geohydrologic studies in India is outlined and modern procedures and techniques for effective groundwater assessment, development, utilization, and control are discussed. Possibilities for large-scale groundwater development have been found in parts of Punjab, Uttar Pradesh, Bihar, West Bengal, Assam, and other areas. Additional study is necessary to determine safe yields and effects of withdrawal. Waterlogging is a severe problem in many irrigated areas. Needs for future hydrologic study, water quality, recharge, conjunctive use, legal aspects, the direction of future work, and water agency organization are also discussed. (Knapp-USGS)
W69-09716

GROUNDWATER RESOURCES OF THE BURIED MAHOMET BEDROCK VALLEY,
Illinois State Water Survey, Urbana. Water Supply Div.
Adrian P. Visocky, and Richard J. Schicht.
Ill State Water Survey, Urbana, Report of Investigation 62, 1969. 52 p, 37 fig, 22 tab, 40 ref.

Descriptors: Analog model, *Aquifer characteristics, Aquifer evaluation, *Bedrock valley, Glacial drift, *Groundwater development, Groundwater recharge, Illinois, Leakage, Water wells.

The buried Mahomet Bedrock Valley and its major tributaries cover about 3700 square miles in east-central Illinois, and form a large underdeveloped groundwater resource. The largest source of groundwater consists of Kansan sands and gravels, called the deep aquifer; the Illinoian or middle aquifer is a secondary source. Pumpage was 40.2 mgd in 1965. Major pumping centers are at Champaign-Urbana, Rantoul, Lincoln, Taylorville and Hoopeston; the largest is Champaign-Urbana with pumpage of 13.5 mgd in 1965. Recharge in the

Champaign-Urbana area was computed to be 115,000 gpd/sq mi for the Illinoian aquifer in 1947 and 107,000 gpd/sq mi for the Kansan aquifer during 1953-1965. Total groundwater runoff for the valley is estimated to be about 740 mgd during years of normal precipitation. Existing and/or future pumping centers might capture 445 mgd. An electric analog computer was constructed for the Champaign-Urbana area. Withdrawals with a selected pumping scheme would total 30.3 mgd from existing large capacity wells and 15 mgd from five future wells. This study provides data for planning and development of area groundwater resources.
W69-09738

QUALITY OF SURFACE WATER IN ILLINOIS, 1956-1966,
Illinois State Water Survey, Urbana. Water Supply Div.
For primary bibliographic entry see Field 02E.
W69-09739

2G. Water in Soils

NUMERIC STUDIES OF A COMPOSITE SOIL MOISTURE GROUNDWATER SYSTEM,
Drexel Inst. of Tech., Philadelphia, Pa.
G. M. Hornberger, Irwin Remson, and A. A. Fungaroli.
Water Resources Res, Vol 5, No 4, p 797-802, Aug 1969. 6 p, 5 fig, 1 tab, 7 ref.

Descriptors: *Groundwater movement, *Soil water movement, *Mathematical models, Model studies, Infiltration, Percolation, Water table, Darcy's law, Dupuit-Forchheimer theory.
Identifiers: Soil water-groundwater relations.

A model of transient moisture movement in a composite soil moisture-groundwater system is described. The model was used to study two-dimensional flow in response to a falling water table. The solution provided information about the interaction of the saturated and unsaturated portions of the subsurface system. The results of the composite model are compared with those obtained from three one-dimensional groundwater models. That soil moisture and nonlinearity do not have a significant effect on the position of the water table in the system studied is inferred. (Knapp-USGS)
W69-09462

INFLUENCE OF PINYON-JUNIPER CONVERSIONS AND WATER QUALITY ON PERMEABILITY OF SURFACE SOILS,
Utah State Univ., Logan; and Forest Service (USDA), Logan, Utah. Forestry Science Lab.
Gerald F. Gifford, and Ronald K. Tew.
Water Resources Res, Vol 5, No 4, p 895-899, Aug 1969. 5 p, 1 fig, 4 tab, 4 ref.

Descriptors: *Watershed management, *Rainfall-runoff relationships, *Clear-cutting, *Infiltration, *Permeability, Surface runoff, Arid lands, Water management (Applied), Pinyon pine trees, Juniper trees, Water quality, Percolation, Regression analysis, Evapotranspiration.
Identifiers: *Watershed clearing.

Chaining with windrowing treatment in the pinyon-juniper vegetation type significantly increased permeability of surface soils from the 0-2 and 2-4 inch depths at a site in southwestern Utah. Double chaining with debris in place did not yield a significant increase in permeability. Permeability of surface soils from a pinyon-juniper site in southeastern Utah provided a similar trend, though significant differences among treatments were not evident. Water quality influenced percolation only after approximately 30 minutes. Multiple regression equations developed for predicting intrinsic permeabilities varied according to water quality. (Knapp-USGS)
W69-09472

STEADY GRAVITATIONAL CONVECTION INDUCED BY A LINE SOURCE OF SALT IN A SOIL,
Agricultural Research Service, Madison, Wis.
P. A. C. Raats.
Soil Sci Soc Amer Proc, Vol 33, No 4, p 483-487, July-Aug 1969. 5 p, 5 fig, 11 ref.

Descriptors: *Convection, *Diffusion, *Aqueous solutions, *Salts, Solutes, Saturated flow, Unsaturated flow, Soil water movement, Groundwater movement, Mass transfer, Ion transport, Hydraulic conductivity, Soil texture.
Identifiers: Salt solution convection.

A theoretical analysis of steady gravitational convection from a line source of salt in a saturated or in a uniformly partially saturated soil is presented. The flow pattern of the water-solute mixture and the distribution of the salt are shown to depend upon the source strength of the line source, the effective mass diffusion coefficient of the salt in the soil, the hydraulic conductivity of the soil, and a parameter describing the increase in density due to the added solute. Qualitatively, the analysis agrees with experimental observations. Theory and experiment both indicate that gravitational convection can be significant only if the hydraulic conductivity is large, which may be the case if the soil is coarse textured and the water content is not too small. (Knapp-USGS)
W69-09475

SOIL-WATER MOVEMENT IN RESPONSE TO IMPOSED TEMPERATURE GRADIENTS,
California Univ., Davis. Dept. of Water Science and Engineering.
D. K. Cassel, D. R. Nielsen, and J. W. Biggar.
Soil Sci Soc Amer Proc, Vol 33, No 4, p 493-500, July-Aug 1969. 8 p, 10 fig, 4 tab, 21 ref, 1 append.
Grant No DAAB G29-07-67-C00034.

Descriptors: *Soil water movement, *Convection, *Water temperature, *Thermodynamic behavior, *Diffusion, Mass transfer, Diffusivity, Water vapor, Thermodynamics, Unsaturated flow.
Identifiers: Temperature gradient, Ficks law.

Redistribution of soil water within insulated, uniformly packed, horizontal samples of unsaturated Columbia fine sandy loam at several soil-water contents was studied in response to imposed temperature gradients ranging from 0.5 to 1.0C/cm. Soil bulk density and initial, transient, and final soil-water-content distributions were determined each 0.5-cm along the column by gamma-radiation attenuation. Initial, transient and final soil temperature distributions were monitored by glass-encased thermistors at 2-cm intervals-both at the center and 0.3 cm from the column wall. Apparent thermal and isothermal soil-water diffusivity values were calculated using transient water content data. The observed net water flux was found to increase with decreasing water content. For Columbia soil the observed mean net water flux across 1-cm sections of the soil showed acceptable agreement with that predicted by the theory of Philip and deVries; Fick's law and the modified Taylor-Cary irreversible thermodynamic equation both underpredicted the observed fluxes. (Knapp-USGS)
W69-09476

WATER MOVEMENT AND FREEZING PRESSURES,
Army Terrestrial Sciences Center, Hanover, N.H. Earth Sciences Branch.
Pieter Hoekstra.
Soil Sci Soc Amer Proc, Vol 33, No 4, p 512-518, July-Aug 1969. 7 p, 12 fig, 1 tab, 14 ref.

Descriptors: *Soil water movement, *Saturated flow, *Freezing, *Frost action, Frost, Ice, Thermodynamic behavior, Laboratory tests, Thawing, Mass transfer.
Identifiers: Ice lenses (Soil), Soil freezing.

Pressures develop when cylindrical column saturated soils are frozen unidirectionally u conditions of constant volume with an open w supply at the warm side. The value and behavi these pressures depend on soil type. If water m tion can take place in the frozen soil and ice le grow behind the freezing front the value of pressure depends on the temperature at the lens. This process occurs in clayey soils, and pressure is theoretically limited by the phase tr tion ice - water. Values of 100 atm have been sured experimentally. In soils where water m tion in the frozen soil does not occur and ice le form at the freezing front, the pressure reach constant value, which may vary between 0.2 for a sand soil and 3 atm for a silt soil. T modynamic models proposed to explain t phenomena are discussed. (Knapp-USGS)
W69-09480

ON THE INTERACTION OF WA MOLECULES AND MONTMORILLONITE S FACES,
Adelaide Univ. (Australia). Dept. of Agricul Biochemistry and Soil Science.
J. W. Kijne.
Soil Sci Soc Amer Proc, Vol 33, No 4, p 539- July-Aug 1969. 5 p, 2 fig, 2 tab, 31 ref.

Descriptors: *Water chemistry, *Adsorp *Clays, *Montmorillonite, *Ion exchange, V pressure, Thermodynamics, Thermodyn behavior, Hydration, Entropy.
Identifiers: Heats of wetting.

The adsorption of water was studied on mono montmorillonite saturated with Cs, Rb, Li, Na monium, and Ca ions. These ions vary in the fluence on the structure of water in solution. the effect on the adsorbed water by exchange could be compared with the effect of these io solution. Heats of wetting of the montmorill samples were determined as a function of equilibrium relative vapor pressure. Entropy v were calculated from the heats of wetting bined with values of the surface potential fro sorption isotherms using the Gibbs surface e equation. The decrease in heats of wetting wi creasing relative vapor pressure was discontin near a relative pressure of 0.1. This was interp as indicating a change at the surface of the mineral probably related to ion hydration ef Consequently the obtained entropy changes c not be assigned entirely to the adsorbed w molecules. At low relative vapor pressures th tropy values strongly reflected the influence o exchange ion which was found to be similar to exerted by these ions in solution. At higher rel vapor pressures the entropy of the system about 4 e.u. below that of liquid water which nearly the same as the likely value for the si sheet itself obtained in earlier studies. (Kn USGS)
W69-09481

KINETICS OF THE FORMATION AND BR DOWN OF A CA-MONTMORILLONITE TOIDS,
Negev Inst. for Arid Zone Research, Beers (Israel). Dept. of Mechanics of Soil and Mater
For primary bibliographic entry see Field 02K.
W69-09482

LEACHING OF ADDED SELENIUM FROM KALINE SOILS AS INFLUENCED SULFATE,
Agricultural Research Service, Kimberly, I Northwest Branch Soil and Water Conserv Research Div.
M. J. Brown, and D. L. Carter.
Soil Sci Soc Amer Proc, Vol 33, No 4, p 563 July-Aug 1969. 3 p, 2 fig, 2 tab, 18 ref.

Descriptors: *Leaching, *Trace elem *Sulfates, *Soils, Soil water movement, Gyp Solubility, Solutes, Aqueous solutions, V

emistry, Soil chemistry, Nutrients, Nutrient quirements, Essential nutrients.
entifiers: Trace nutrients, Barium, Selenium, hite muscle disease.

barium sulfate-selenate mixture (S:Se= 10) and rium selenate alone were applied at 1.60 and 20 mg Se per column to two soils and leached ith 800 ml of leaching solution added to columns ntaining 2,100 g of Portneuf silt loam and 2,500 of Gooding loamy sand at 4-week intervals for 20 eeks. More Se was leached by gypsum solution an by water from all columns. Where 3.20 mg Se r column was applied, more Se was leached by ater from Gooding than from Portneuf soil, but e reverse was true with gypsum solution. The Se ached from the Portneuf soil ranged from 0.34 g, where 1.60 mg Se per column was applied and ils leached with water, to 2.32 mg, where 3.20 mg e per column was applied and soils leached with psum solution. Much less Se was leached where ly barium selenate was applied to Portneuf soil. he amount leached ranged from 0.07 mg, where 60 mg Se was applied and water used for aching, to 0.64 mg Se, where 3.20 mg Se was ap- ied and gypsum used for leaching. The Se leached creased with application rate, but not propor- onately. It is concluded that addition of sulfate in- reases the solubility of barium selenate in these ils. (Knapp-USGS)
69-09483

ONTROL OF POTASSIUM RELEASE AND EVERSION ASSOCIATED WITH CHANGES N SOIL MOISTURE,
owa State Univ. of Science and Technology, mes. Dept. of Soil Science.
or primary bibliographic entry see Field 02K.
69-09484

YDROLOGIC AND MORPHOLOGIC IMPLI- ATIONS OF ANISOTROPY AND INFILTRA- ION IN SOIL PROFILE DEVELOPMENT,
echnion - Israel Inst. of Tech., Haifa. Dept. of gricultural Engineering; and Agricultural esearch Service, Beltsville, Md. Hydrograph Lab.
an Zaslavsky, and A. S. Rogowski.
oil Sci Soc Amer Proc, Vol 33, No 4, p 594-599, uly-Aug 1969. 6 p, 6 fig, 11 ref, append.

escriptors: *Soil water movement, *Soil profiles, Anisotropy, *Soil formation, *Infiltration, Per- olation, Leaching, Topography, Geomorphology, oil moisture, Runoff, Soil erosion.
dentifiers: Soil profile development.

he concept of anisotropy as a possible factor of oil formation is introduced and the hydrologic and orphologic implications of water infiltration are emonstrated. It is concluded that the magnitude nd direction of downhill flux of infiltrating water ill depend on the degree of anisotropy as well as n the land slope and its changes. This conclusion ay explain in part the greater differentiation of orizons on flat lands than on sloping lands, and the radual thinning out of the B horizon uphill as the lope increases. (Knapp-USGS)
69-09485

OORLY DRAINED SOILS WITH PER- IAFROST IN INTERIOR ALASKA,
rmy Terrestrial Sciences Center, Hanover, N.H.; nd Dartmouth Coll., Hanover, N. H. Dept. of arth Sciences.
. J. Allan, Jerry Brown, and Samuel Rieger.
oil Sci Soc Amer Proc, Vol 33, No 4, p 599-605, uly-Aug 1969. 7 p, 3 fig, 2 tab, 25 ref.

escriptors: *Wetlands, *Permafrost, *Alaska, Arctic, Freezing, Thawing, Clays, Silts, Sands, article size, Soil classifications, Soil formation, oil investigations, Soil moisture, Soil properties, oil profiles, Frozen ground, Trace elements.
dentifiers: Gley soils, Histic pergelic cryaquepts.

Physical, chemical, and mineralogical properties are presented for 5 soils with permafrost in interior Alaska. The soils are shallowly thawed, with permafrost usually at 60 cm or less, and with a thick accumulation of organic matter, usually about 25 cm deep, over a gleyed mineral soil. They are classified as Histic Pergelic Cryaquepts in the comprehensive soil classification system adopted by the US Department of Agriculture. Histic Pergelic Cryaquepts are the most extensive soils developed over permafrost in Alaska. In three of the 5 profiles, particle-size analyses reveal a slight increase (2-4%) in clay content of the thawed mineral soil over that of the permafrost. The coarsest horizon in all 5 profiles contains only 48% sand. The dominant texture is silt loam. In one of the profiles, base saturation increases (52%-90%) with depth in the thawed mineral soil, then remains fairly constant in the permafrost. Percent Zr (0.02%) remains constant in the coarse silt fraction of all horizons of all 5 profiles both above and in the permafrost. The dominant clay minerals in the thawed horizons were vermiculite and kaolinite. (Knapp-USGS)
W69-09486

PHYSICAL PROPERTIES OF PEATS AS RELATED TO DEGREE OF DECOMPOSITION,
Forest Service (USDA), Grand Rapids, Minn. Northern Conifers Lab.
D. H. Boelter.
Soil Sci Soc Amer Proc, Vol 33, No 4, p 606-609, July-Aug 1969. 4 p, 4 fig, 3 tab, 6 ref.

Descriptors: *Soil physical properties, *Peat, Soil structure, Soil classifications, Organic matter, Hydraulic conductivity, Permeability, Water yield, Decomposing organic matter.
Identifiers: Peat fiber content.

Important physical characteristics, such as water retention, water yield coefficient, and hydraulic conductivity, vary greatly for representative northern Minnesota peat materials. The differences are related to the degree of decomposition, which largely determines the porosity and pore size distribution. Fiber content and bulk density are properties often measured to indicate the degree of decomposition of peat materials and are criteria used to distinguish fibric, hemic, and sapric peat types. Regression analysis showed a curvilinear relationship of water contents at saturation, 5 mbar, 0.1 bar, and 15 bar suctions, to fiber content and bulk density with coefficients of multiple determination ranging from .66 to 0.88. Regression analysis of the logarithm of hydraulic conductivity on fiber content and bulk density indicate a linear relationship although not as strong, due to the variability of hydraulic conductivity. It is concluded that the classification of peat materials and organic soils based primarily on degree of decomposition as measured by fiber content and bulk density relates significant information about their physical characteristics. (Knapp-USGS)
W69-09487

EVAPORATION FROM A SIMULATED SOIL SHRINKAGE CRACK,
Agricultural Research Service, Temple, Tex. Soil and Water Conservation Research Div.; and Agricultural Research Service, Big Spring, Tex. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02D.
W69-09488

CHEMICAL AND BIOLOGICAL WEATHERING IN VERMICULITE FROM TRANSVAAL,
Yale Univ, New Haven, Conn. School of Forestry.
For primary bibliographic entry see Field 02K.
W69-09489

THE EMF OF PLATINUM ELECTRODES IN DILUTE SOLUTIONS AND ITS RELATION TO SOIL pH,
Arizona Univ., Tucson. Dept. of Agricultural Chemistry and Soils.
For primary bibliographic entry see Field 02K.
W69-09490

REPLACEMENT OF WATER BY AIR IN SOIL PORES,
National Research Council of Canada, Ottawa (Ontario).
P. J. Williams.
Norw Geotech Inst, Publ Nr 72, p 75-90, 1968. 16 p, 12 fig, 12 ref.

Descriptors: Soil engineering, *Soil mechanics, Soil moisture, Soils, Soil properties, Soil tests, *Soil water, *Soil water movement, Moisture content, Capillary action, Capillarity, Capillary water, Pore pressure, Pores, Pore water pressures, Negative poor pressure, Diffusion, *Airwater interfaces.
Identifiers: Soil pore structure, Soil moisture storage, Soil suction, Soil-water interface, Soil-water interaction, Pore structure.

Soils composed of minerals having the same refractive index as water are translucent when saturated. Any air in the pores is fully visible. Such soils have been used to observe how air may replace water in soil pores. Three distinct processes that may occur in a soil when a difference in pressure P is established between the air and water are: (1) A process explained by capillary theory. If this process alone occurs, it gives a curve of moisture content versus P in which there is a conspicuous air-intrusion value of P, corresponding to an interface radius r sub c equal to that of the largest continuous openings through the soil. (2) A process that occurs more slowly, involving diffusion of air (from air external to the sample) to entrapped air bubbles, with a resulting enlargement of these. (3) A process of slow advance of interfaces into the soil, possibly due to a change with time, of interfacial energy, contact angle, or interface radius, or to a process not explained by the capillary theory. Advancement occurs under constant P. Additional drainage may occur because of consolidation caused by stresses on the soil skeleton, arising from the air-water pressure difference. This drainage may occur suddenly with the development of cracks in the soil. (USBR)
W69-09525

FACTORS INFLUENCING SOIL-MOISTURE RELATIONSHIPS IN UNDRAINED FORESTED BOGS,
Forest Service (USDA), Grand Rapids, Minn. North Central Forest Experiment Station.
Roger R. Bay.
Proceedings, International Symposium on Forest Hydrology, Pergamon Press, oxford, England, p 335-343, 1967. 9 p, 2 tab, 4 fig, 25 ref.

Descriptors: *Bogs, *Swamps, *Soil moisture, *Organic soils, Forest soils, Saturated soils, Water table, Groundwater, Hydrology, Soil physical properties, Peat, Minnesota.
Identifiers: *Peatlands, *Bog hydrology, Peat bogs, Groundwater bogs.

Saturated bogs or peatlands are found in all parts of the world, yet they receive little attention from hydrologists. Studies in northern Minnesota, U.S.A., have shown that a number of factors influence soil-moisture relationships and water storage characteristics in forested bogs. Various peat types were found to have significantly different physical properties which, in turn, directly affect water retention and water movement rates in bogs. Hydrogeologic conditions, particularly the influence of the regional groundwater system or the lack of such influence, directly affect bog water table fluctuations. Other factors such as hydrometeorologic events, vegetation characteristics, and evapotranspiration losses influence the soil-moisture regime. In the study bogs, soil moisture conditions were directly related to, and often described by, the position of the water table in the organic soil profile. The height of the bog water table, in turn, influenced storage capacity and runoff from the entire bog watershed.
W69-09570

HYDROLOGIC CHARACTERISTICS OF ORGANIC SOILS IN LAKE STATES WATERSHEDS,
Forest Service (USDA), Grand Rapids, Minn. North Central Forest Experiment Station.
Don H. Boelter.
J Soil and Water Conserv, 1966, 21 (2): 49-53. 5 p, 4 fig, 2 tab, 14 ref.

Descriptors: *Hydrologic properties, *Organic soils, *Peat, *Bogs, Watersheds (Basins), Bogs, Saturated soils, Water table fluctuations, Soil physical properties, Water storage, Hydraulic conductivity, Bulk density, Water contents, Storage capacity, Porosity, Minnesota.
Identifiers: *Bog hydrology, Peatlands, Peat types, Degree of decomposition, Pore size distribution, Wetland hydrology.

The physical properties of peats determine to a large degree the role of a given bog in the local and regional water regime. Studies have shown that most bogs are not the good water storage reservoirs they are often thought to be. Certain types of undecomposed moss peats appear to have a large capacity for water storage but actually provide little storage because their large pores release the water so quickly. Decomposed and herbaceous peats, on the other hand, provide little storage capacity because little water is removed from their small pores when the water table is lowered. This paper summarizes some of the hydrologic characteristics of several peat types studied over the past few years and relates these to land productivity and watershed values. Land managers must learn to recognize differences in peat types and understand their role in watershed management to properly manage over 15 million acres of peatlands in the northern Lake States.
W69-09573

HYDRAULIC CONDUCTIVITY OF PEATS,
Forest Service (USDA)Rapids, Minn. North Central Forest Experiment Station.
D. H. Boelter.
Soil Sci, 1965, 100 (4): 227-231. 5 p, 2 tab, 14 ref.

Descriptors: *Hydraulic conductivity, *Peats, *Water movement, *Saturated flow, Soil physical properties, Bulk density, Porosity, Water storage, Organic soils, Bogs, Hydrologic properties, Specific yield, Minnesota.
Identifiers: *Peat types, Pore size distribution, Horizontal hydraulic conductivity, Vertical hydraulic conductivities.

The rate of water movement through and out of a bog area will depend largely on the peat material found in the organic soil profile. In most lake-filled bogs water flows through moss peat horizons near the surface and little flows through dense herbaceous peats at lower horizons. In other types of bogs with different peat profiles, more flow may occur at greater depths. Hydraulic conductivities (or water movement rates) of peat types were found to cover a wide range of values. The values were related to specific yield and to pore-size distribution. Field-measured hydraulic conductivities of peats were significantly lower than corresponding laboratory values, and these field values were accepted as more accurately representing water movement rates of organic soils. Further analysis indicated no significant difference between vertical and horizontal hydraulic conductivity as measured by the tube and piezometer methods.
W69-09574

IMPORTANCE OF VOLUMETRIC EXPRESSION OF WATER CONTENTS OF ORGANIC SOILS,
Forest Service (USDA), Grand Rapids, Minn. North Central Forest Experiment Station.
D. H. Boelter, and G. R. Blake.
Soil Sci Soc Amer Proc, 1964, 28 (2): 176-178. 3 p, 3 fig, 1 tab, 5 ref.

Descriptors: *Water content, *Bulk density, *Peat, *Organic soils, Soil physical properties, Bogs, Swamps, Soil water, Hydrologic properties, Soil physics, Soil analysis, Saturated soils, Water storage, Minnesota.
Identifiers: *Volumetric water contents, Peatlands, Bog hydrology.

Methods for evaluating water contents and bulk densities of several different peats are compared, Because bulk densities (saturated volume basis) of moss, herbaceous, and aggregated peats varied from 0.028 to 0.249 g. per cc., a highly distorted impression of the amount of water actually held under field conditions is given if water values are expressed on an oven-dry weight basis. On a wet-volume basis, moss peat held only 10 to 20% more water at saturation than did herbaceous and aggregated peat and retained less water than they did at higher suctions. Between 0.1 and 15 bars, moss peat retained about one-quarter the volume of water of a medium-textured mineral soil, Barnes loam. Since considerable volume reduction occurs on drying, bulk density of oven-dry peat, Db (dry volume basis), represents an artificial condition rarely, if ever, occurring in undrained bogs. Bulk densities must, therefore, be calculated on the basis of the wet bulk volume and are referred to as Db (wet bulk volume). A more precise expression of degree of wetness may be substituted for 'wet' in the wet volume basis term.
W69-09575

WATER STORAGE CHARACTERISTICS OF SEVERAL PEATS IN SITU,
Forest Service (USDA), Grand Rapids, Minn. North Central Forest Experiment Station.
D. H. Boelter.
Soil Sci Soc Amer Proc, 1964, 28 (3): 433-435. 3 p, 3 fig, 2 tab, 5 ref.

Descriptors: *Water storage, *Peats, *Organic soils, *Porosity, *Storage coefficient, Soil physical properties, Bogs, Swamps, Bulk density, Soil water, Hydrologic properties, Available moisture, Moisture tension, Water level fluctuations, Minnesota.
Identifiers: *Water storage capacity, *Pore size distribution, *Peat type, Available water, Water suction.

Water storage characteristics of the various horizons in a northern Minnesota bog were found to vary considerably with peat type. Surface horizons of sphagnum moss peat contain 0.020 g. per cc. of dry material and 95 to nearly 100% water by volume at saturation. Its total porosity consisted primarily of large pores which released 0.80 cc. of water per cc. between saturation and 0.1 bar suction. Decomposed and herbaceous peats from horizons below 25 cm. had water-holding properties strikingly different from those of the moss peats. These materials had bulk densities of 0.24 and 0.14 g. per cc., respectively, and they contained between 80 and 90% water by volume at saturation. Their porosity, though high, consisted primarily of many small pores which are not easily drained at low suctions. They retained 65 to 75% water by volume at 0.1-bar suction. These data show that a specific change in water table elevation in the horizons containing loose, porous, undecomposed moss peat would involve a great deal more water than the same change in horizons of more dense decomposed and herbaceous peats. Thus, the hydrologic role of any bog or bog area in a watershed will depend on the type of peat found in the organic soil profile.
W69-09576

PLANNING AND INTERPRETING SOIL PERMEABILITY MEASUREMENTS,
Agricultural Research Service, Phoenix, Ariz., Water Conservation Lab.
Herman Bouwer.
ASCE Proc, J Irrig and Drainage Div, Vol 95, No IR3, Pap 6775, p 391-402, Sept 1969. 12 p, 4 fig, 3 tab, 19 ref, append.

Descriptors: *Permeability, *Soil water moveme *Measurement, *Planning, Instrumentati Drainage engineering, Infiltration, Hydraulic c ductivity, Irrigation design.
Identifiers: Soil permeability measurement.

Field techniques for measuring soil hydraulic c ductivity (below the water table as well as above in the absence of, a water table) are considered selecting a technique for a given situation, c should be taken that the soil region and domin flow direction in the system to be analyzed or p dicted are as closely duplicated by the techniqu possible. If the soil region covered by an individ measurement is small compared to that of the tual system, measurements at different depths locations are necessary. The resulting values seldom if ever be uniform and simplification manageable media may be required. The aver hydraulic conductivity of a randomly heteroge ous medium must lie between the harmonic and arithmetic mean. Studies with a resistance netw analog show that this average hydraulic conduct ty is best estimated by the geometric mean. napp-USGS)
W69-09658

QUICK-RETURN SUBSURFACE FLOW,
Agricultural Res Service, Beltsville, Md. Hyd graph Lab.; and Agricultural Research Servi Madison, Wis. Soil and Water Conservation Div
D. G. Jamieson, and C. R. Amerman.
J Hydrol, Vol 8, No 2, p 122-136, June 1969. 1 1 tab, 16 ref.

Descriptors: *Soil water movement, *Subsurf runoff, *Routing, *Surface-groundwater relati ships, Water storage, Model studies, Mathemati models, Simulation analysis, Hydrograph analy Systems analysis, Infiltration, Overland flow, P colation.
Identifiers: Quick-return subsurface flow.

One of the least understood of all hydrolo problems is that of lateral flow in the soil's up horizons. The nature and quantity involved in t quick-return flow are unknown and have to be ferred from the shape of the observed hydrogra An attempt has been made to mathematically sir late the flow phenomenon using rainfall as in and a system of interconnected, nonlinear res voirs as the operator. (Knapp-USGS)
W69-09665

SOIL MOISTURE CONDITION MEASU MENT AS A STREAMFLOW FORECASTI PARAMETER,
Soil Conservation Service, Boise, Idaho.
Morlan W. Nelson.
J Soil and Water Conserv, Vol 24, No 4, p 147-1 Aug 1969. 2 p, 3 tab.

Descriptors: *Soil moisture, *Snowpacks, *Sn surveys, *Runoff forecasting, Statistical metho Regression analysis, Streamflow forecasting, Sn management, Snowmelt.
Identifiers: *Boise River (Idaho), Payette Ri (Idaho), Salmon Falls Creek (Nev).

Soil moisture stations were established on sn courses known to correlate with streamflow in Western U.S. Readings are taken mont throughout the winter months and are used to c rect snowpack data. Regression analysis results tabulated for the Boise River near Boise Ida Payette River near Horseshoe Bend, Idaho, Salmon Falls Creek near San Jacinto, Nevada. napp-USGS)
W69-09672

SP LOG INTERPRETATION IN SHALY SAN
Koninklijke-Shell Exploratie en Produktie Labo torium, Rijswijk (The Netherlands).
For primary bibliographic entry see Field 02F.
W69-09699

OLE OF SOIL MOISUTRE IN THE YDROLOGICAL CYCLE,
ntario Agricultural Coll., Guelph. School of gricultural Engineering.
D. Ayers.
oc Hydrol Symp No 6, Nov 15-16, 1967. Soil oisture, Nat Res Counc of Canada, p 3-21, 1968. p, 1 fig, 20 ref.

escriptors: *Soil moisture, *Vadose water, ydrologic cycle, *Evapotranspiration, *Water alance, Moisture stress, Snowmelt, Precipitation tmospheric), Transmissivity, Retention, roundwater recharge, Freezing, Watersheds asins), Model studies.
entifiers: *Soil moisture system, Watershed sponse model.

he soil moisture system is examined and discussed relation to the role of soil in influencing moisture tention, detention, transmission or rejection of nfall or snowmelt throughout the watershed. Soil oisture in the water cycle is defined qualitatively. he zone of soil moisture is critical in the hydrolog-al cycle because movements to and from this he are an integral part of groundwater recharge, apotranspiration, crop-moisture studies, and of e effects of freezing-thawing cycles. Moisture he data are essential in the water balance studies any localized or regional area or stream basin. he author emphasizes integration of soil moisture to the hydrological cycle and concludes with the esentation of a conceptual model of a basin for il-strative purposes. (Lang-USGS)
69-09705

H. Lakes

ENERATION OF AN EVAPORATION TIME ERIES FOR LAKE ONTARIO,
ornell Univ., Ithaca, N.Y.
or primary bibliographic entry see Field 02D.
69-09461

UMMARY OF RESERVOIR SEDIMENT EPOSITION SURVEYS MADE IN THE NITED STATES THROUGH 1965.
gricultural Research Service, Oxford, Miss. Sedi-entation Lab.
or primary bibliographic entry see Field 02J.
69-09493

EDIMENTATION OF RESERVOIRS,
entral Soil Mechanics Research Station, New elhi (India).
or primary bibliographic entry see Field 02J.
69-09657

SCILLAXANTHIN IN THE SEDIMENT OF AKE WASHINGTON,
ashington Univ., Seattle, Dept. of Zoology.
ary Griffiths, Pamela S. Perrott, and W. T. dmondson.
mnol and Oceanogr, Vol 14, No 3, p 317-326, ay 1969. 10 p, 1 fig, 2 tab, 22 ref. Grant GB-51X (NSF).

escriptors: *Lakes, *Sediments, Pigments, Washington, Organic matter, Plankton, Sewage, roductivity, Chemical analysis, Algae, Spec-oscopy, Sedimentation rates, Erosion.
entifiers: Lake Washington sediment.

scillaxanthin in Lake Washington sediment was etermined quantitatively from cores cut in slices 1 n thick. The pigment content varies with depth nsistently in all cores; however, the amount of gment per unit dry weight of sediment is highest the surface and has two subsurface maxima at 4 n depth and 7 to 9 cm depth. The total accumu-ted pigment under unit area of bottom mud varies om 27.10 to 6.66 microgram/sq cm. The oscillax-nthin-producing algae evidently were somewhat fferently distributed during sedimentation, for e differences are not related to differences in dis-ibution of the plankton. The study indicates that the first appearance of oscillaxanthin probably came early in the period of sewage enrichment that led to the recent diversion of sewage from Lake Washington. (Gabriel-USGS)
W69-09675

THE ANNUAL AND DIURNAL VARIATION IN THE VERTICAL DISTRIBUTION OF ACID-SOLUBLE FERROUS AND TOTAL IRON IN A SMALL DIMICTIC LAKE,
Atomic Energy of Canada Ltd., Chalk River (Ontario). Biology and Health Physics Div.
For primary bibliographic entry see Field 05A.
W69-09677

SOME PHOTOSYNTHETIC CHARACTERISTICS OF A NATURALLY OCCURRING POPULATION OF OSCILLATORIA AGARDHII GOMONT,
Minnesota Univ., Minneapolis. Dept. of Ecology and Behavioral Biology.
A. L. Baker, A. J. Brook, and A. R. Klemer.
Limnol and Oceanogr, Vol 14, No 3, p 327-333, May 1969. 7 p, 5 fig, 15 ref.

Descriptors: *Algae, *Photosynthesis, *Lakes, *Population, *Minnesota, Productivity, Oxygen, Analytical techniques, Light intensity, Water chemistry, Water temperature, Plankton, Phytoplankton, Nutrients.
Identifiers: Lake Itasca (Minn).

Both absolute and relative values of net photosynthesis were measured directly in a field experiment conducted on August 7, 1967 using an almost monospecific natural population of the blue-green alga Oscillatoria agardhii. Relatively short (2-hr) incubation periods were utilized so that diurnal curves could be established. The net rate of oxygen production varies with light intensity reaching light saturation at near 10% of the maximum insolation. High rates of production occur during twilight at the surface, and the highest production is at 30% of noon intensity. Light quality, as well as intensity, is important, and filtering effect of lake water enhances subsurface oxygen production even at relatively high light intensities. (Gabriel-USGS)
W69-09678

SEASONAL FLUCTUATIONS OF LAKE MICHIGAN DIATOMS,
Bureau of Commercial Fisheries, Ann Arbor, Mich.
Ruth E. Holland.
Limnol and Oceanogr, Vol 14, No 3, p 423-436, May 1969. 14 p, 7 fig, 3 tab, 32 ref.

Descriptors: *Diatoms, *Lake Michigan, *Seasonal, Sampling, Plant populations, Biomass, Analytical techniques, Chemical analysis, Water analysis, Nitrates, Phosphates, Chlorophyll.
Identifiers: Lake Michigan diatoms.

Water samples containing diatoms were collected at 4 areas of Lake Michigan and Green Bay from April to November 1965. The flora of the lake is characterized by 7 diatom species and the Green Bay water is characterized by 6 species, with Stephanodiscus niagarae dominating the biomass of the Bay. There was an average of 517 diatoms per ml in the lake and 944 per ml in Green Bay. Diatom abundance appeared to have 1 peak in the lake and 2 peaks in the bay. The higher population near the eastern shore of the lake and in Green Bay appeared to be correlated with higher concentrations of phosphorous and chlorophyll and lower concentrations of nitrate. (Gabriel-USGS)
W69-09679

CHANGES IN THE WATERS OF THE DANUBE REGION IN THE BLACK SEA AND THE EFFECT ON ANCHOVY BREEDING,
Odessa State Univ. (USSR). Dept. of Hydrobiology.
For primary bibliographic entry see Field 02L.
W69-09702

PHYSICOCHEMICAL LIMNOLOGY AND RELATED FISH DISTRIBUTION OF KEYSTONE RESERVOIR,
Oklahoma State Univ., Stillwater. Aquatic Biology Lab.
Rex L. Eley, Neil E. Carter, and Troy C. Dorris.
Reservoir Fish Resources Symp, Georgia Univ. Apr 5-7, 1967, p 333-357, 1967. 25 p, 21 fig, 8 tab, 20 ref.

Descriptors: *Limnology, *Reservoirs, *Fisheries, *Water quality, *Thermal stratification, Chemical stratification, Density stratification, Hypolimnion, Dissolved oxygen, Water temperature, Conductivity, Alkalinity, Decomposing organic matter, Anaerobic conditions, Carbon dioxide, Turbidity, Light penetration.
Identifiers: *Keystone Reservoir (Ark), *Physicochemical limnology, Vertical fish distribution.

Water temperature, conductivity, pH, alkalinity, carbon dioxide, specific gravity, oxygen, turbidity, and light penetration were determined for each meter of depth at 4 stations along the Cimmaron arm of Keystone Reservoir from September 1965 through August 1966. Occasional measurements were also made at several points on the Arkansas arm and below Keystone Dam. The vertical fish distribution was also determined. Chemical and thermal stratifications due to density differences between Arkansas and Cimarron River waters were present in Keystone Reservoir during all seasons. Relatively high concentrations of carbon dioxide, hydrogen sulfide, and ammonia accumulated in the hypolimnion as a result of organic matter decomposition under anaerobic conditions. However, water quality in the hypolimnion improved as a result of oxygenation during discharge. It was concluded the vertical distribution of fish was highly temperature dependent. Also, oxygen values lower than 2 mg/l was a limiting factor for the fish distribution in Keystone reservoir. (Carstea-USGS)
W69-09708

THE ENVIRONMENT AND PLANKTON DENSITY IN MISSOURI RIVER RESERVOIRS,
Bureau of Sport Fisheries and Wildlife, Yankton, S. Dak.
N. G. Benson, and B. C. Cowell.
Reservoir Fish Resources Symp, Georgia Univ, Apr 5-7, 1967, p 358-373, 1967. 6 p, 6 fig, 3 tab, 19 ref.

Descriptors: *Reservoirs, *Productivity, *Plankton, *Water quality, *Missouri River, Zooplankton, Phytoplankton, Density currents, Turbidity, Water temperature, Ions, Diatoms, Chemical stratification, Copepods.
Identifiers: *Missouri River reservoirs, Plankton density.

Morphometry, water chemistry, temperature, currents, turbidity, and phytoplankton were studied in the 6 main reservoirs on the Missouri River, which have a total area of 463,000 ha. Each reservoir is covered yearly by ice from 85 to 123 days. Heavy winds and currents prevent stratification in the upper 12 m of water of the large reservoirs. Generally, density currents are not common in the reservoirs. Turbidity is caused by fine sand, silt and clay particles. Calcium, magnesium, bicarbonates, and sulfates occur in relatively high concentrations. Chemical stratification was found in Garrison Reservoir. Diatoms dominate the flora; the maximum densities of phytoplankton occurred in spring and early summer, as well as in late summer and fall. Among zooplankton, Cladocera and Copepoda showed little vertical or horizontal stratification in Lewis and Clark Lake. Protected areas in Oahe Reservoir have higher zooplankton densities than unprotected areas. Turbidity is the strongest limiting factor for plankton development in the reservoirs. The dynamics of the plankton in a reservoir can be understood only in the amounts of inflowing, indigenous and discharging plankton are known. (Carstea-USGS)
W69-09709

PHYSICOCHEMICAL LIMNOLOGY OF FOUR RESERVOIRS IN SOUTHWEST NEBRASKA,
Bureau of Sport Fisheries and Wildlife, Billings, Mont.; and Nebraska Game, Forestation, and Parks Commission, Lincoln.
Donald L. Tennant, Robert E. Thomas, and Joe Gray.
Reservoir Fish Resources Symp, Georgia Univ, Apr 5-7, p 537-540, 1967. 4 p.

Descriptors: *Limnology, *Reservoir fisheries, *Thermocline, *Nebraska, *Water quality, Water temperature, Dissolved oxygen, Reservoirs, Stratification, Outlets, Physical properties, Chemical properties.
Identifiers: *Reservoir limnology, Nebraska reservoirs.

Physicochemical data from 4 reservoirs in Nebraska taken within a 30-hr period in August, revealed moderate thermal stratification, closely associated in 2 reservoirs with the functioning low-level outlet. The reservoirs with thermoclines exhibited greater temperature ranges and contained cooler waters than did reservoirs without thermoclines. The distribution of fish as detected on sonar often revealed the presence and location of a thermocline prior to physical or chemical data verification. Without exception, the larger the reservoir and the lower the outlet, the better the reservoir fishery. Downstream fisheries ranked the same with one exception. (Carstea-USGS)
W69-09712

EUTROPHICATION FACTORS IN NORTH CENTRAL FLORIDA LAKES,
Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
For primary bibliographic entry see Field 05C.
W69-09723

USE OF LIGHT NUCLIDES IN LIMNOLOGY,
Yale Univ., New Haven, Conn. Geochronometric Lab.; and Yale Univ., New Haven, Conn. Dept. of Geology.
For primary bibliographic entry see Field 05C.
W69-09745

THE PRESENT STATE OF LAKE ZURICH (IN GERMAN),
Kantonales Laboratorium, Zurich (Switzerland). Limnologische Abteilung.
E. A. Thomas, and E. Marki.
Proc of the International Association of Theoretical and Applied Limnology, Vol 10, p 476-488, 1949. 9 fig.

Descriptors: *Eutrophication, *Lakes, Limnology, Hydrogen ion concentration, Cycling nutrients, Phytoplankton, Temperature, Nitrates, Ammonia, Phosphorus, Manganese, Chlorides, Sulfates.
Identifiers: Lake Zurich (Switzerland), Switzerland, Oscillatoria rubescens, Oxidation capacity, Solid matter.

The first part of the paper by Thomas reports, largely in graphic form, monthly or occasional changes in nutrient content (nitrate, ammonia, phosphorus, manganese) temperature, and density of plankton, particularly that of Oscillatoria rubescens, in Lake Zurich. Observations cover a period from October 1943 to December 1947, and from surface to 140 meter depths. The second part of the report, by Marki, gives account of changes that took place during the same period in the contents of oxygen, calcium carbonate, carbon dioxide, pH value, chloride and sulphate ions, oxidation capacity, and solid matter on air-dry and oven-dry basis. (Wilde-Wis)
W69-09746

THE IONIC COMPOSITION OF LAKE WATERS,
Uppsala Univ. (Sweden). Inst. of Limnology.
Wilhelm Rodhe.
Proc of the International Association of Theoretical and Applied Limnology, Vol 10, p 377-386, 1949. 21 fig, 2 tab, 4 ref.

Descriptors: *Ions, *Lakes, *Water chemistry, Limnology, Electrolytes, Statistics, Water analysis, Colloids, Geochemistry, Conductivity.
Identifiers: Seawater minerals, Freshwater minerals, Bicarbonate water types, Standard water composition, Conductivity of lake waters.

The author subjected to statistical treatment 5,300 analytical values on Swedish lakes, given in the voluminous monograph of G Lohammar's 'Wasserchemie und Hohere Vegetation Schwedischer Seen' (1938). Examination of recalculated data revealed a surprisingly close coincidence of the average composition of Swedish lakes with that of freshwaters (lakes and rivers) of the world, as given by F W Clarke in his 'Data of Geochemistry' (1911). The author attributes this coincidence to ionic exchanges between free ions and the colloidal systems of soils and lake muds. He concludes that there is no need for a complete water analysis of bicarbonate lakes having the same content of electrolytes, as expressed by the conductivity of the water and the concentration of the major constituents (calcium, magnesium, sodium, potassium, chloride, sulfate, and bicarbonate ions). (Wilde-Wis)
W69-09747

SEDIMENTATION IN ARTIFICIAL LAKES,
Soil Conservation Service, Washington, D.C.
Stafford C. Happ.
A Symposium on Hydrobiology, p 35-44, 1941. Wisconsin Univ Press, Madison. 2 tab.

Descriptors: *Lakes, *Sedimentation, Floods, Erosion, Chaparral, Grazing, California.
Identifiers: Deforestation, Erosion intensity, Lake capacity, Los Angeles (Calif).

Detailed surveys by the U S Soil Conservation Service and other agencies, of 148 artificial lakes showed the following average annual loss of the water-retaining volume of artificial lakes due to sedimentation of erosion products: 34 lakes, less than 0.5%; 39 lakes, 0.5 to 1%; 39 lakes, 1 to 2%; 36 lakes, over 2%. The latter figure includes 11 lakes in the Los Angeles, California, area surveyed after the catastrophic flood of 1938. For an appraisal of the erosion intensity, accumulation of sediment per unit of drainage area (in cubic feet per acre) is more significant than the reduction in the capacity of lakes. Cultivation of soils, overgrazing, deforestation, and burning off the chaparral or brush are the major causes of excessive sedimentation. (Wilde-Wis)
W69-09748

INCREASE IN THE CONTENT OF ORTHO-PHOSPHORUS AS AN EXPRESSION OF PROGRESSIVE EUTROPHICATION OF LAKE CONSTANCE (GERMAN),
Institut fur Seenforschung und Seenbewirtschaftung Langenargen am Bodensee.
Richard Kliffmuller.
Int Revue ges Hydrobiologie, Vol 47, No 1, p 118-122, 1962. 1 fig, 1 tab, 12 ref.

Descriptors: *Phosphorus compounds, *Eutrophication, Oligotrophy, Lakes, Water analysis, Limnology, Nutrients, Cycling nutrients, Turnovers, Thermal stratification.
Identifiers: *Lake Constance (Switzerland), Switzerland, Germany.

The change which Lake Constance has undergone from the oligotrophic state to a moderately eutrophic condition is expressed by a rather sharp curve for the water content of ortho-phosphorus. In 1958-1959, the curve attained its peak at approximately 9 milligrams/cubic meter of ortho-phosphorus. The author stresses the importance of confining water analyses to the end of turnover, i.e., months of March or April, depending on weather conditions of the year. (Wilde-Wis)
W69-09752

CHEMICAL INVESTIGATION OF LAKE SED MENTS AND THEIR INTERPRETATION,
Freshwater Biological Association, Windermere (England).
F. J. H. Mackereth.
Proc Royal Society, B, Vol 161, p 295-309, 196 14 fig, 4 ref.

Descriptors: *Chemical properties, *Lakes, *Sed ments, Carbon cycle, Clay, Erosion, Climat Leaching, Deforestation, Halogens, Peat, Pollen Connecticut, Chlorine.
Identifiers: English Lake District, Linsley Po (Conn), Chemical stratigraphy, Elemental ratio Bromine, Altitudinal effects.

The content of organic carbon is considered as t most important variable of lake sediments. T composition of sediments is attributed to geologic features and the history of watersheds, rather th the composition of lake basins. To some exte sediments reflect the stability of land surfaces. T sediment content of potassium and sodium ma serve as a gauge of the intensity of post-glacial er sion. The presence of calcium suggests incidence severe denudations. The sequence of changes lake sediments is influenced by variation in climat conditions, impoverishment of soils by leachi and deforestation. Climatic conditions of the pa were appraised on the basis of the content halogens (chlorine, bromine) transported from th ocean and indicating oceanity of climate. (Wild Wis)
W69-09754

CONTROL OF SEDIMENTATION AND BO TOM CONFIGURATION BY CONVECTIO CURRENTS, LAKE WASHINGTON, WASHIN TON,
Humble Oil and Refining Co., Houston, Tex.; a Coast Guard, Woods Hole, Mass.
Howard R. Gould, and Thomas F. Budinger.
Journal of Marine Research, Vol 17, p 183-19 1958. 6 fig, 10 ref.

Descriptors: *Sedimentation, *Convection, *Cu rents (Water), Glacial drift, Glaciation, Mud, Ter perature, Circulation, Radioactive dating, Sed ments, Washington, Clay, Lakes, Limnology.
Identifiers: *Bottom configuration, *La Washington (Wash), Seattle (Wash), Lake topo raphy, Physical limnology.

Lake Washington, in Seattle's environs, occupies deep, narrow W-shaped trough in cross sectio sculptured by the last continental glacier. The sed ments consist of blue clay of meltwater origi more than 100 feet thick, overlain by limnic gytt 5 to 55 feet thick. Core profiles across the la show that the trough was U-shaped at the close the blue-clay deposition and that the W-shape profile had its present configuration for approx mately 6,700 years. Sedimentation rates differe appreciably even over short distances over the la bottom. Investigations of lake temperature profile together with model experiments to simulate cond tions of convective flow, point to convection cu rents as responsible for the observed variations sedimentation of gyttja which, in turn, account f the unusual W-shaped configuration of the troug floor. (Bortleson-Wis)
W69-09757

THE STUDY OF LAKE DEPOSITS,
Freshwater Biological Association, Ambleside (E gland).
B. M. Jenkin, C. H. Mortimer, and W. Pennington
Nature, April 1941, Vol 147, p 496-500. 2 fig, ref.

Descriptors: *Cores, *Analytical technique *Lakes, *Deposition (Sediments), Peat, Diatom Pollens, Sediments, Clays, Bioindicators.
Identifiers: Lake Windermere (England), Ech sounding machine, Clay bands, Peat bands.

nethod for extracting undisturbed core samples
m bottom deposits of lakes has been developed.
mination of obtained core samples confirms the
ue of the echo-sounding machine as a means of
viding information on certain types of lake
osits, and, in part, on the climatic and biological
ory of lakes. Examples of core samples ex-
ted from the bottom of Lake Windermere are
cribed. (Wilde-Wis)
9-09758

PORTANCE OF THE BOIS BRULE RIVER
RECENT SEDIMENTATION HISTORY OF
STERN LAKE SUPERIOR,
sconsin State Univ., Superior.
primary bibliographic entry see Field 02J.
9-09773

Water in Plants

FLUENCE OF PINYON-JUNIPER CONVER-
NS AND WATER QUALITY ON PERMEA-
ITY OF SURFACE SOILS,
h State Univ., Logan; and Forest Service
SDA), Logan, Utah. Forestry Science Lab.
primary bibliographic entry see Field 02G.
9-09472

OUNDWATER AND VEGETATION IN TWO
AT BOGS IN NORTHERN MINNESOTA,
est Service (USDA), Grand Rapids, Minn.
th Central Forest Experiment Station.
primary bibliographic entry see Field 02F.
9-09569

ME CHARACTERISTICS OF VEGETATION
VELOPMENT IN THE FLOODPLAIN OF OB
ER IN THE TAIGA ZONE (RUSSIAN),
ingrad State Univ. (USSR).
fe. Rodnyanskaya.
tnik, Leningr Univ, No 24, Geol-Geogr, Issue 4,
27-134, 1968. 8 p, 1 fig, 1 tab, 4 ref.

criptors: *Vegetation, *Floodplains, *River
ins, Geology, Geomorphology, Climates,
drologic porperties, Seasonal, Floods, Runoff.
ntifiers: *USSR, Ob River, Siberia.

etation of floodplains of the Ob River, Siberia,
investigated on the basis of floral, geological,
hydrologic data. The severe climate, long
ng, and summer flooding are responsible to a
tt extent for the vegetation development in the
dplain areas. Grass predominates over trees
shrubs. In general the vegetation of the Ob
er plain can be subdivided into 4 altitude belts
n of which is characterized by a certain duration
looding and definite intensity of alluvial accu-
ation. (Gabriel-USGS)
9-09700

Erosion and Sedimentation

ECTS OF CARBONATE SEDIMENTATION
THE ATLANTIC CONTINENTAL SHELF
THE SOUTHERN UNITED STATES,
e Univ., Durham, N.C. Dept. of Geology; and
e Univ., Durham, N.C. Marine Lab.
n H. Pilkey, Blake W. Blackwelder, Larry J.
le, Ernest Estes, and P. Michael Terlecky.
diment Petrol, Vol 39, No 2, p 744-768, June
9. 25 p, 15 fig, 4 tab, 32 ref.

criptors: *Sedimentation, *Limestones, *Car-
ates, *Atlantic Coastal Plain, *Continental
f, Particle size, Shallow water, Particle shape,
mentation rates, Sedimentology, Geochemis-
Sedimentary structures.
tifiers: Atlantic Continental Shelf.

r 1,000 sediment samples from the Atlantic
inental shelf off the southern United States
investigated to determine the usefulness of
carbonate fraction in studying shelf history in a so-called 'noncarbonate' area. Particle characteristics of the carbonate fraction are emphasized. These include particle rounding and the proportions of fragmental, blackened, and of worn versus fresh components. The abundance of carbonates is mainly a function of the amount of dilution by terrigenous materials from Piedmont rivers. Calcium carbonate is least abundant on the Georgia shelf and increases greatly to the south and slightly to the north. The abundant of black shells, oolites, and shallow water fauna over large portions of the shelf shows a shallow-water origin of much of the shelf surficial material. The abundance of worn and broken shells reflects the low rate of sedimentation. Much of the present shelf sediment cover was originally deposited in the nearshore zone of the last transgressing sea, not the beach environment, as indicated by particle roundness. The areal distribution of certain carbonate fraction parameters can be interpreted as linear patterns paralleling the present shorelines. These may reflect ancient shorelines. (Knapp-USGS)
W69-09492

SUMMARY OF RESERVOIR SEDIMENT DEPOSITION SURVEYS MADE IN THE UNITED STATES THROUGH 1965.
Agricultural Research Service, Oxford, Miss. Sedimentation Lab.

US Department of Agriculture, Misc Publication No 1143, May 1969. 64 p. Dendy, F. E., and Champion, W. A., Compilers.

Descriptors: *Reservoir silting, *Sedimentation, *On-site data collections, *United States, Documentation, Surveys, Watersheds (Basins), Sediment yield, Drainage systems, Inter-Agency Comm on Water Resources, Publications.
Identifiers: *Water Resources Council, Data sources.

Data from reliable reservoir sedimentation surveys made in the United States through 1965, and from surveys made after 1965 for a few reservoirs, are presented in a summary table. All of the 48 conterminous States, except Maine and Florida, and Puerto Rico, are included. An index of river basin maps and a sample form for reporting the data are given. This publication supersedes and updates USDA Miscellaneous Publication 964, published in May 1964. All surveys reported in that bulletin have been repeated here. Reservoirs are grouped according to the 79 drainage areas as divided by the Subcommittee on Hydrology, Federal Inter-Agency River Basin Committee, now under jurisdiction of the Water Resources Council. Surveys range from reconnaissance measurements of sediment depth at a few locations to detailed surveys based on closely spaced cross sections or contours. Total drainage area includes the reservoir and area lying above all upstream dams but generally excludes noncontributing areas within the basin boundary. Where available, USGS drainage area figures are used. (Lang-USGS)
W69-09493

SEDIMENT BUDGET ALONG A BARRIER ISLAND CHAIN,
Smithsonian Institution, Washington, D.C.; and George Washington Univ., Washington, D.C.
J. W. Pierce.
Sediment Geol, Vol 3, No 1, p 5-16, Mar 1969. 12 p, 4 fig, 1 tab, 23 ref. Grant No G-16362 (NSF).

Descriptors: *Sedimentation, *Sedimentation rates, *Islands, *Barriers, *Provenance, Coasts, Mapping, Erosion, Biomass, Tertiary period, Dunes, Wind erosion, Topography, Sands, Saltation, Petrography, Continental shelf, Currents (Water), Waves (Water).
Identifiers: North Carolina coastal sedimentation.

Physiographic changes along a coast are used to define the sediment budget of a stretch of the coast, if reliable historical records are available. This physiographic method was applied to the study of the North Carolina coast located between Cape Hatteras and Cape Lookout. The accretion of sediment has occurred at the average annual rate of 796,000 cubic meters with the material supplied by longshore drift, transportation from the mainland, and the continental shelf acting as a reservoir of the sediment that is presently accreting in the nearshore area. (Gabriel-USGS)
W69-09494

THERMAL AND ELECTRICAL CONDUCTIVITIES OF SANDSTONE ROCKS AND OCEAN SEDIMENTS,
Oregon State Univ., Corvallis. Dept. of Oceanography; and National Academy of Sciences-National Research Council, Washington, D.C. Div. of Earth Sciences.
For primary bibliographic entry see Field 02F.
W69-09498

RESTORATION OF GULLIED VALLEY FLOORS IN ARID AND SEMIARID REGIONS,
Geological Survey, Washington, D.C.
Norman J. King.
Proc 23rd Int Geol Congr, Vol 12, p 187-195, 1968. 9 p, 2 fig, 16 ref.

Descriptors: *Accelerated erosion, *Gully erosion, *Erosion control, Land management, Runoff, Aggradation, Check structures, Diversion structures, Slope protection, Soil conservation, Vegetation establishment.
Identifiers: Eroded land restoration, Semiarid regions.

The causes and effects of accelerated soil erosion in overgrazed grassed valleys are discussed and methods of restoring gullied land are outlined. Runoff and erosion are increased by soil compaction and by removal of plant cover. Studies of ephemeral stream channels show that natural processes of gully widening and meandering tend to result ultimately in aggradation. Aggradation can also be increased by artificial obstructions placed in channels or by decreasing discharge. Not all gullied valleys are equally amenable to treatment. The areas where some aggradation is already taking place respond best. Narrow rapidly eroding gullies should be allowed to widen before starting treatment. Runoff control should be applied evenly over an eroding basin so that aggradation is as uniform as possible. Runoff control measures should be applied mainly to noneroding parts of basins so that as much water as possible, and as little sediment as possible is withheld from the gully net. This increases aggradation in channels at the same time it retards reservoir silting in water control structures. (Knapp-USGS)
W69-09506

MEASUREMENT OF SAND TRANSPORT IN RIVERS WITH SPECIAL REFERENCE TO TRACER METHODS,
Hydraulics Research Station, Wallingford (England).
M. J. Crickmore.
Sedimentology, Vol 8, No 3, p 175-228, May 1967. 54 p, 28 fig, 1 plate, 6 tab, 30 ref, append.

Descriptors: *Sediment transport, *Bed load, *Rivers, *Tracers, Tracking techniques, Model studies, Hydraulic models, Estuaries, Sands, Silts, Radioactivity techniques, Dye releases, Statistical methods.
Identifiers: Bed load tracers.

Tests were made on a small river to examine the practicability of tracer measurements of sand transport in rippled beds in natural channels. The spatial integration, time integration, and steady dilution methods were examined by using radioactive and fluorescent tracers. The serious limitations of the time integration and steady dilution methods under conditions of unsteady solids discharge were exposed by a sudden flood discharge occurring during the course of the study. An approximate method

based on the time integration approach but also requiring some spatial tracer data yields an estimate of the transport in the case of highly variable sand discharge, but the spatial integration method offers the most workable and informative tracer method for use in natural rivers. The results were generally consistent with those given by the summation of the measured suspended solids flux and bed load, determined from the downstream advance of ripple bed-forms. Methods are described for bed load estimation from ultrasonic echo sounder records of bed profiles. Sand transport values are calculated for a number of river discharges and for 2 laboratory channel tests using various procedures by Einstein, Bagnold, Meyer-Peter and Muller, and Laursen. Significant differences in the computed values for individual flow conditions are observed. (Knapp-USGS)
W69-09507

METHODS OF STRUCTURAL AND GEOMORPHOLOGICAL ANALYSIS OF RIVER VALLEYS (RUSSIAN),
Kharkov State Univ. (USSR).
For primary bibliographic entry see Field 02A.
W69-09514

SUCCESSFUL SAND CONTROL DESIGN FOR HIGH RATE OIL AND WATER WELLS,
Signal Oil and Gas Co., Los Angeles, Calif.
David H. Schwartz.
J Petrol Technol, p 1193-1198, Sept 1969. 6 p, 4 fig, 4 tab, 19 ref.

Descriptors: *Design criteria, *Water wells, *Well filter, *Gravels, *Sands, Filtration, Erosion control, Cohesionless soils, Sediments.
Identifiers: *Gravel packs, Sand control (Water wells).

Methods for sand control in high-rate water and oil wells are outlined. Gravel pack design criteria are given for various unconsolidated sands, flow velocities, and well fluids. Design procedures are given in detail. (Knapp-USGS)
W69-09649

SEDIMENTATION OF RESERVOIRS,
Central Soil Mechanics Research Station, New Delhi (India).
I. C. dos M. Pais-Cuddou, and N. C. Rawel.
ASCE Proc, J Irrig and Drainage Div, Vol 95, No IR3, Pap 6789, p 415-429, Sept 1969. 15 p, 8 tab.

Descriptors: *Reservoir silting, *Bed load, *Suspended load, Reservoir storage, Sediment load, Forecasting, Sedimentation, Sediment yield, Silts, Sands, Gravels.
Identifiers: *India, Reservoir sedimentation studies.

The methods of estimating reservoir sedimentation used in India are outlined. During the planning stage, the only method available for predicting the life of a reservoir or the sedimentation rate is to conduct sediment observations on the river. Accurate measurement of suspended sediment load, assumption of the required quantity of bed load, unit weight of sediment, and proportion of the grades of sediment likely to be deposited are some of the important items which need to be taken into consideration. After a reservoir has been built, the rate of sediment deposition can be determined either by measurement of inflow and outflow of sediment or by conducting actual capacity surveys of the reservoir by echo sounding instruments. The latter method is comparatively more accurate and the results obtained are well within 10% of the true value. Contrary to previous experience, it has been found that the percentage of fine-grade sediment trapped in the reservoir is considerably higher than the coarse and medium grade of sediment. Several factors control the location of sediment deposits in the reservoir. The reservoir operation schedule is one of the major factors as well as the shape and size of the reservoir, amount and characteristics of the sediment load, valley slope, and vegetation at the head of reservoir. It has been found that the sediment deposition is not only restricted to dead storage but that it also affects the live storage space. (Knapp-USGS)
W69-09657

SOIL EROSION CONTROL PRACTICES IN PERSPECTIVE,
Harza Engineering Co., Chicago, Ill.
Paul Jacobson.
J Soil and Water Conserv, Vol 24, No 4, p 123-126, Aug 1969. 4 p, 2 fig, 10 ref.

Descriptors: *Soil erosion, *Erosion control, *Check structures, *Farm management, Contour farming, Embankments, Land forming, Land management, Slope protection, Soil conservation, Strip cropping, Terracing, Water control.
Identifiers: *Tillage practices.

Many standard soil erosion control practices have proven impossible to sell to farmers, and some are no longer applicable to farming practices now in use. The standard practices are reviewed and suggestions are made for their modification or replacement in cases of lack of use or obsolescence. Contouring is not suitable for large-scale mechanized farming in humid areas. Crop rotation is no longer necessary to add nitrogen, and is not used by farmers who do not need grass crops. Strip cropping is seldom used in corn areas or by non-users of grass. Terracing is effective if constructed properly but more research on the relation of terrace shape to land and climate conditions is needed to utilize the system well. Tillage practices are used well in many cases, but more need to be established for various crop-weather-runoff situations. It is concluded that Corn Belt farmers will accept only no-flow till-plant minimum tillage programs with water control by storage fills across waterways. Use of this system can reduce downstream sediment and nutrient loads to very low levels. (Knapp-USGS)
W69-09660

SOIL EROSION AND CONSERVATION IN NORTHERN JORDAN,
Durham Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 04D.
W69-09663

OSCILLAXANTHIN IN THE SEDIMENT OF LAKE WASHINGTON,
Washington Univ., Seattle, Dept. of Zoology.
For primary bibliographic entry see Field 02H.
W69-09675

SEDIMENT MOVEMENT IN AN AREA OF SUBURBAN HIGHWAY CONSTRUCTION, SCOTT RUN BASIN, FAIRFAX COUNTY, VIRGINIA, 1961-64,
Geological Survey, Washington, D.C.
R. B. Vice, H. P. Guy, and G. E. Ferguson.
Geol Surv Water-Supply Pap 1591-E, p E1-E41, 1969. 41 p, 13 fig, 11 tab, 10 ref.

Descriptors: *Sediment yield, *Urbanization, *Road construction, *Virginia, Highways, Runoff, Soil erosion, Sediment load, Sampling, Surveys, Excavation, Water pollution sources, Water pollution effects, Sedimentation.
Identifiers: Highway construction sediment yield, Fairfax County (Va).

Movement of sediment during a period of intensive highway construction was studied in the Scott Run basin, Fairfax County, Va., from 1961 to 1964. The 4.54 sq mi drainage basin, which empties into the Potomac River about 6 mi above the head of the Potomac Estuary, was the scene of highway construction covering 11% of the basin; other types of urban construction in the basin during this time were minor. Sediment was measured at the gaging station by a system of representative samples. These samples made it possible to document the sediment yield for 88 storm events representing overland runoff. The 88 events accounted for 3 of the runoff and 99% of the sediment movemer 3% of the time. The highway construction ar varying from less than 1 to more than 10% of basin at a given time, contributed 85% of the s ment; 38% of the sediment movement occu during April, May, and June, and only 11% curred during July, August, and September; an the basis of residual soil and stream-sediment p cle sizes, the amount of sediment eroded f areas of construction was about twice that tra ported from the basin. Sediment yield is about times that normally expected from cultivated la 200 times that expected from grassland, and 2, times that expected from forest land. (Kna USGS)
W69-09683

CONTROL OF SEDIMENTATION AND B TOM CONFIGURATION BY CONVECT CURRENTS, LAKE WASHINGTON, WASHI TON,
Humble Oil and Refining Co., Houston, Tex.;
Coast Guard, Woods Hole, Mass.
For primary bibliographic entry see Field 02H.
W69-09757

IMPORTANCE OF THE BOIS BRULE RIV TO RECENT SEDIMENTATION HISTORY WESTERN LAKE SUPERIOR,
Wisconsin State Univ., Superior.
A. B. Dickas, and P. C. Tychsen.
Wisc State Univ, Research Report, 1969. 2
OWRR Proj A-023-Wis.

Descriptors: *Sedimentation, Lake Super Wisconsin, Petrology, Suspended-load.
Identifiers: *Bois Brule River (Wis), *Sedimen analysis, Sedimentation history.

A sedimentary analysis was made of the bed suspended load of the Bois Brule River, Dou County, Wisconsin to better understand the stat cal characteristics of the clastic materials b transported by this stream and its contributio the Holocene sedimentation history of the Wisc sin shoreline of Lake Superior. In addition bedr and glacial deposits were mapped throughout drainage basin. The average mean size distribu of the clastic load, based on the phi scale, is as lows: 10% granules, 74% sand, 13% silt and clay. To determine whether this dominantly sa sized sediment was derived from basement roc glacial debris, stream gravels larger than gra size were petrographically analyzed and compa to surficial and basement rock maps. Results dicate that the glacial cover is the prime sourc the clastic material of the river load, concur with the mapping program which shows that wash sands and reworked glacial drift predomi over much of the drainage area. A second source is outcropping Keweenawan (Cambr sandstones. Earlier studies indicate the river loa deposited in Lake Superior out to a distance one-half to one mile from the shoreline with finer material found at the greater distance f the littoral zone.
W69-09773

2K. Chemical Processes

HYDROCALCITE AND NESQUEHONITE CARBONATE SCALES,
Heidelberg Univ. (West Germany). Sediment L
Hannelore Marschner
Science, Vol 165, No 3898, p 1119-1121, Sept 1969. 3 p, 1 fig, 3 tab, 6 ref.

Descriptors: *Scaling, *Calcium carbonate, *M nesium carbonates, Hardness (Water), Cal Limestones, Carbonate rocks, Chemical precip tion, Water chemistry, Chemical reactions.
Identifiers: *Hydrocalcite.

drocalcite with exactly one molecule of hydrate ter is the main component of carbonate scales posited from cold water in contact with air. hen the magnesium content of the water is high, hydrocalcite occurs together with squehonite. From the conditions under which drocalcite is transformed into calcite and agonite., it appears that in some cases aragonite nature may be formed by way of an intermediary hydrocalcite. (Knapp-USGS)
69-09449

N THE INTERACTION OF WATER OLECULES AND MONTMORILLONITE SUR-ACES,
lelaide Univ. (Australia). Dept. of Agricultural ochemistry and Soil Science.
r primary bibliographic entry see Field 02G.
69-09481

INETICS OF THE FORMATION AND BREAK-OWN OF A CA-MONTMORILLONITE TAC-OIDS,
gev Inst. for Arid Zone Research, Beersheba srael). Dept. of Mechanics of Soil and Materials.
Shainberg, and A. Kaiserman.
il Sci Soc Amer Proc, Vol 33, No 4, p 547-551, ly-Aug 1969. 5 p, 5 fig, 8 ref.

escriptors: *Ion exchange, *Clays, *Montmoril-nite, Ion transport, Sodium, Calcium, Floccula-on, Colloids, Adsorption, Diffusion.
entifiers: *Tactoid formation.

he kinetics of Ca-montmorillonite tactoid forma-on and breakdown was followed by recording the anges in light transmission as a function of time hen Ca-montmorillonite suspensions of 0.05% /v) concentration were added to Na-montmoril-nite suspensions of the same concentration in a rating vessel placed in the light path of a ecrophotometer. Tactoid formation was found to instantaneous whereas the breakdown of Ca tac-ids took about 10 min. It was suggested that the itial step upon mixing sodium and calcium mont-orillonite was the redistribution of adsorbed ions. or tactoids to break, ions have to interdiffuse into e tactoids. Since the mobility of ions adsorbed on e internal surfaces is low, tactoid breakdown is ow. Ion diffusion on the single platelets of Na clay nd the external surfaces of the tactoids is high; us the formation of tactoids is instantaneous. (K-app-USGS)
69-09482

EACHING OF ADDED SELENIUM FROM AL-ALINE SOILS AS INFLUENCED BY ULFATE,
gricultural Research Service, Kimberly, Idaho. orthwest Branch Soil and Water Conservation esearch Div.
or primary bibliographic entry see Field 02G.
69-09483

ONTROL OF POTASSIUM RELEASE AND EVERSION ASSOCIATED WITH CHANGES N SOIL MOISTURE,
wa State Univ. of Science and Technology, mes. Dept. of Soil Science.
E. Bates, and A. D. Scott.
oil Sci Soc Amer Proc, Vol 33, No 4, p 566-568, ly-Aug 1969. 3 p, 1 fig, 2 tab, 5 ref.

escriptors: *Ion exchange, *Potassium, *Soils, Wetting, *Drying, Hysteresis, Nutrients, eaching, Ion transport, Soil moisture, Soil water ovement, Organic matter.
lentifiers: Potassium fixation.

he changes in exchangeable K that occur when oils are dried and rewet, and the affect of organic dditives on these changes were determined with 0 soils from the North Central Region of the USA. he release of K associated with drying was essen-ally eliminated by adding dextrose to the soils be-fore drying. The use of dried samples for the deter-mination of the exchangeable K in field-moist soils will be limited to some extent, however, because some soils fix K when the are dried and dextrose does not prevent fixation. In most cases, a decrease in exchangeable K occurred when air-dry soils were rewet. A greater decrease in exchangeable K was attained with all soils when the air-dry, rewet samples were redried in the presence of octanol. In some cases, only the reversion of K released by drying was involved, and the decrease was not enough to reduce the exchangeable K level to that in undried soil. In others, K fixation occurred and the heated soils contained less exchangeable K after treatment than they had in their field-moist state. Nevertheless, the octanol treatment resulted in improved estimates of plant-available K and of exchangeable K in undried soil samples over those obtainable with either air-dry or air-dry rewet samples. (Knapp-USGS)
W69-09484

HYDROLOGIC AND MORPHOLOGIC IMPLICATIONS OF ANISOTROPY AND INFILTRATION IN SOIL PROFILE DEVELOPMENT,
Technion - Israel Inst. of Tech., Haifa. Dept. of Agricultural Engineering; and Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
For primary bibliographic entry see Field 02G.
W69-09485

CHEMICAL AND BIOLOGICAL WEATHERING IN VERMICULITE FROM TRANSVAAL,
Yale Univ, New Haven, Conn. School of Forestry.
B. L. Sawhney, and G. K. Voigt.
Soil Sci Soc Amer Proc, Vol 33, No 4, p625-629, July-Aug 1969. 5 p, 5 fig, 16 ref.

Descriptors: *Weathering, *Soils, *Mineralogy, *Clays, Ion exchange, Salts, Solutes, Aqueous solutions, Expansive clays, Expansive soils, Leaching, Chemical reactions, Biodegradation.
Identifiers: *Vermiculites, Interlayer expansion, Electron microprobe analysis, Structure (Mineralogic).

Transvaal vermiculite flakes were weathered in solutions of salts or acids as well as in nutrient solutions inoculated with water extracts of soils from hemlock (Tsuga canadensis) and tulip poplar (Liridendron tulipifera) forest stands. Morphological changes were studied with a microscope and the structural changes were determined by X-ray diffraction analysis, while the changes in chemical composition were estimated by an electron microprobe. Weathering of flakes proceeded from edges inward and produced a weathered zone parallel to the flake edges. However, the changes produced by salt solutions were different from those by acids and biological agents. Treatment with salt solutions produced the expanded weathered zone with the 14A c-axis spacing as compared to 10A spacing of the unaltered zone. Electron microprobe analysis revealed that the salt treatment replaced the interlayer K ions by the hydrated cations of the salt. Treatment with acids or biological agents, on the other hand, produced a bleached and fragile weathered border that was amorphous to X-rays. Electron microprobe analysis showed that the bleached zone was depleted of Fe, Mg, and Al, besides the interlayer K ions; concentration of these cations decreased towards the extremity of the edge. The amorphous nature of the weathered zone is attributed to the loss of the unit cell periodicity resulting from the removal of a portion of the octahedral and tetrahedral cations. (Knapp-USGS)
W69-09489

THE EMF OF PLATINUM ELECTRODES IN DILUTE SOLUTIONS AND ITS RELATION TO SOIL pH,
Arizona Univ., Tucson. Dept. of Agricultural Chemistry and Soils.
H. L. Bohn.
Soil Sci Amer Proc, Vol 33, No 4, p 639-640, July-Aug 1969. 2 p, 1 tab, 11 ref.

Descriptors: *Soil water, *Water chemistry, *Electrochemistry, *Instrumentation, *Calibrations, Electrodes, Electrical properties, Aqueous solutions, Hydrogen ion, concentration, Oxidation-reduction potential.
Identifiers: Electrode potentials, Platinum electrodes.

An equation is derived for mixed potentials of electrodes which explains their non-Nernstian behavior in dilute solutions and at nonequilibrium conditions. Adding iron (II) sulfate to soil suspensions resulted in E/pH slopes which were unrelated to the reaction taking place because E is a mixed potential and because the pH is governed to a significant extent by non-redox reactions. (Knapp-USGS)
W69-09490

FIELD DETERMINATION OF SULFATE CONTENT IN SOILS,
California State Dept. of Water Resources, Sacramento.
H. J. Miller, and D. G. Knight.
Tech Memo No 37, Dept Water Resour, Calif, Jan 1969. 10 p, 4 fig, 1 plate, 1 ref, 2 append.

Descriptors: *Chemical analysis, Chemical precipitation, Gypsum, *Sulfates, Test procedures, Volumetric analysis, Quantitative analysis, Soil analysis, Soil investigations, *Soil tests, Field tests, Subsurface investigations, Engineering geology, Soluble salts, Soil chemistry.
Identifiers: Sulfate attack.

A rapid chemical test, developed for determining sulfate in natural soils, is based on the direct relationship between sulfate content and the volume of white precipitate. The soil sample is placed in 3N HCl to dissolve the sulfate, the solution is filtered into a graduated test tube, and barium chloride is added to the filtrate to precipate the sulfate. The volume of the precipitate is read directly in the test tube. Test tubes are calibrated with standard samples. A testing kit developed for field use is described. (USBR)
W69-09530

EFFECT OF LIGHT INTENSITY ON PHOTOSYNTHESIS BY THERMAL ALGAE ADAPTED TO NATURAL AND REDUCED SUNLIGHT,
Indiana Univ., Indianapolis. Dept. of Microbiology.
Thomas D. Brock, and M. Louise Brock.
Limnol and Oceanogr, Vol 14, No 3, p 334-341, May 1969. 8 p, 7 tab, 19 ref.

Descriptors: *Photosynthesis, *Algae, *Thermal springs, *Light intensity, Spring water, Water chemistry, Water temperature, Chemical analysis, Analytical techniques, Cloud cover, Spectroscopy, Ultraviolet radiation, Transmissivity, Chlorophyll.

The effect of light intensity on thermal algae of hot springs of Yellowstone National Park was investigated by measuring autoradiography of photosynthetic activity of cells at different levels in the algae mat. The rate of photosynthesis decreases progressively with decreasing light, although the most efficient use is at 7-14% of full sunlight. The chlorophyll content of the algae at the surface of the mat increases rapidly; however, the chlorophyll content of the mat increases slowly or not at all. Although individual algae cells can adapt rapidly to changes in light, the entire population, because of its existence in compact mats, adapts slowly. At the latitude of Yellowstone there is sufficient light throughout the whole year to stimulate the algae growth even at critical temperatures. (Gabriel-USGS)
W69-09676

SOME PHOTOSYNTHETIC CHARACTERISTICS OF A NATURALLY OCCURRING POPULATION OF OSCILLATORIA AGARDHII GOMONT,
Minnesota Univ., Minneapolis. Dept. of Ecology and Behavioral Biology.
For primary bibliographic entry see Field 02H.

W69-09678

CHEMICAL SEPARATION AND SPECTROCHEMICAL DETERMINATION OF MICROGRAM QUANTITIES OF GERMANIUM IN NATURAL WATER OF HIGH HEAVY-METAL CONTENT,
Geological Survey, Sacramento, Calif.
Alex E. Dong.
Geol Surv Ann Rev, Short Pap Contrib, 1969.

Descriptors: *Germanium, *Trace elements, *Spectroscopy, *Water chemistry, Geochemistry, Chemical techniques, Saline water, Heavy metals.
Identifiers: Chemical separation, Natural water.

A procedure is described for the chemical separation and determination of microgram quantities of germanium in water of high heavy-metal content. Before being subjected to spectrochemical determination, germanium is selectively isolated from other major and minor elements in water in order to avoid undesirable dilution effects. The average error for 8 determinations is about 8.5% and the relative standard deviation is 8.0%.
W69-09684

SOLVENT STABILITY AND RECOVERY IN SOLVENT EXTRACTION DESALINATION,
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 03A.
W69-09692

THE CALCIUM, MAGNESIUM, POTASSIUM, AND SODIUM BUDGETS FOR A SMALL FORESTED ECOSYSTEM,
Dartmouth Coll., Hanover, N.H. Dept. of Biological Sciences.
G. E. Likens.
Ecology, Vol 48, No 5, p 772-785, 1967. 8 fig, 11 tab, 41 ref.

Descriptors: *Calcium, *Magnesium, *Potassium, *Cycling nutrients, *Ecosystems, *Forests, New Hampshire.
Identifiers: Cation losses, Balance (Exchangeable bases), Weathering rates, Hubbard Brook Experimental Forest (NH), New Hampshire.

The balance of exchangeable bases was studied in six watersheds of the Hubbard Brook Experimental Forest, N H, forested by northern hardwoods, with some spruce and fir at higher elevations. Samples of precipitation and stream water were collected from June 1963 until June 1965. The budget of dissolved cations was calculated from input (concentration of cations times volume of precipitation) and discharge (concentration of cations times volume of runoff). During 1963-1965, the average annual inputs (in kilograms/hectare) were: calcium (Ca) 2.9, magnesium (Mg) 0.9, potassium (K) 2.15, sodium (Na) 1.55, while the discharge averaged calcium 5.95, magnesium 2.2, potassium 1.45, and sodium 5.2. The net loss of calcium, magnesium, and sodium represents conservative measurement of weathering. The potassium budget approaches balance, and this cation may serve as the sensitive index of biological activity. (Wilde-Wis)
W69-09750

THE CONCEPT OF PRODUCTIVITY IN BIOLOGY (GERMAN),
August Thienemann.
Archiv fur Hydrobiologie, Vol 22, p 616-622, 1931.

Descriptors: *Productivity, Fertility, Aquatic productivity, Lakes, Ponds, Nutrients, Harvesting.
Identifiers: Productive potential, Actual productivity, Site quality.

This is a discussion of the manifold meaning of the term 'productivity', or 'site quality' of different media of production, including lakes and ponds. This expression in hydrobiology, as in forestry or farming, involves several concepts: 'fertility of a medium,' referring primarily to the supply of available nutrients; 'productive potential,' implying a possibility of utilization of the medium by suitable forms of life, i.e., fish, trees, or farm crops; 'actual productivity,' depending to a large degree upon the organisms which at the present occupy the substrate, their rate of growth and value to man. In many instances, the actual productivity of a medium is far below its productive potential. (Wilde-Wis)
W69-09751

IONIC COMPOSITION OF SAGEHEN CREEK, CALIFORNIA, FOLLOWING AN ADJACENT FIRE,
California Univ., Berkeley. Dept. of Soils and Plant Nutrition; and California Univ., Berkeley. Dept. of Zoology.
C. M. Johnson, and P. R. Needham.
Ecology, Vol 47, No 4, p 636-639, Summer 1966. 2 fig, 2 tab, 8 ref.

Descriptors: *Ions, *Streams, *Forest fires, Hydrogen ion concentration, Bicarbonates, Calcium, Magnesium, Sodium, Potassium, California, Springs, Water chemistry.
Identifiers: Sagehen Creek (Calif), Donner Ridge (Calif), Sagehen Basin (Calif).

Water samples from Sagehen Creek, Calif, were collected at biweekly intervals for two years following the Donner Ridge forest fire which burned over the lower part of Sagehen Basin in 1960. Sampling included a spring which feeds the stream above the burned area and two sites in the stream, one above the burned area below the spring, and one within the burned area. Analyses included pH, bicarbonate, calcium, magnesium, sodium, and potassium. Seasonal variation in ionic composition was observed at both sampling sites. In contrast to the constant composition of the spring water for the two year period, the ionic concentration in the samples was inversely related to streamflow. In summer, streamflow was low and stream ionic concentrations equalled or exceeded those of the spring water. During runoff from melting snow (March-June), streamflow increased greatly and ionic concentration decreased. There was no specific effect of the fire on the ionic composition of the stream. It is postulated that ash constituents were dissolved by light rainfall and leached into the permeable forest soil before the first snow. Because of acid soil, the dissolved cations were adsorbed by exchange colloids rather than washed into the stream. (Wilde-Wis)
W69-09753

ASSAY OF UREASE ACTIVITY USING CARBON 14-UREA IN STORED, GEOLOGICALLY PRESERVED, AND IN IRRADIATED SOILS,
California Univ., Berkeley. Dept. of Soils and Plant Nutrition.
J. J. Skujins, and A. D. McLaren.
Soil Biology and Biochemistry, Vol 1, p 89-99, 1969. 8 fig, 3 tab, 34 ref.

Descriptors: *Soils, *Soil analysis, Nitrogen cycle, Enzymes, Irradiation, Carbon, Hawaii, Radioisotopes, Radioactive dating, Puerto Rico, Alaska.
Identifiers: *Urease activity, *Carbon-14, Sample storage, Sterilization, Hilgard soil collection.

During a period of 26 months of air-dry storage of Hawaiian and Puerto Rico latosols, one soil showed an increase in activity to 108.5% and others a decrease to as little as 36%. Urease activity found in 6 to 12 years stored, air-dry agricultural soils correlated with the organic matter content rather than with the numbers of microorganisms. In samples from the 60-years-old Hilgard soil collection, urease activity reflected both the organic carbon content and the numbers of organisms present. Measurable urease activities were detected in 8715 and 9550-years-old, radiocarbon dated, Alaska permafrost samples. No activity was detected in a 32,000-years-old sample. No urease activity was present in two high-salinity soils. Urease acti was usually found in neutral soils. A high-ene electron-beam irradiation dosage of 4 Mrad creased urease activity in some soils, but decrea activity in two others. Doses of 8 Mrad decrea urease activity below their native levels in all s Evidently, an intracellular urease compon becomes more accessible to substrate upon de of organisms. A new method for urease acti determination in soils was devised, based on the tection of carbon-14-labelled carbon diox release from carbon-14-urea-amended s (Keeney-Wis)
W69-09756

2L. Estuaries

ASPECTS OF CARBONATE SEDIMENTATI ON THE ATLANTIC CONTINENTAL SHE OFF THE SOUTHERN UNITED STATES,
Duke Univ., Durham, N.C. Dept. of Geology;
Duke Univ., Durham, N.C. Marine Lab.
For primary bibliographic entry see Field 02J.
W69-09492

SEDIMENT BUDGET ALONG A BARRI ISLAND CHAIN,
Smithsonian Institution, Washington, D.C.;
George Washington Univ., Washington, D.C.
For primary bibliographic entry see Field 02J.
W69-09494

GROUNDWATER FLOW IN THE NETHI LANDS DELTA AREA AND ITS INFLUEN ON THE SALT BALANCE OF THE FUTU LAKE ZEELAND,
Institute for Land and Water Managem Research, Wageningen (Netherlands).
L. F. Ernst.
J Hydrol, Vol 8, No 2, p 137-172, June 1969. 3 11 fig, 5 tab, 42 ref.

Descriptors: *Water quality, *Saline water syste *Groundwater movement, *Saline water intrusi *Drainage systems, Streamflow, Water chemis Mathematical models, Saline water-freshwater terfaces, Diffusion, Water balance.
Identifiers: *Netherlands, Polders, Lake Zeelan

Five estuaries in the southwest of the Netherla will be shut off from the sea by large dams, wh will be completed about 1980. The sea branc between Walcheren-Zuid-Beveland and Goe Overflakkee will form the new Lake Zeeland partial diversion of the discharge of the riv Rhine and Meuse through the new lake will hav favorable influence on the desalting of the lake calculation of the rate of desalting is importan view of the possibilities of domestic, agricult and industrial use of this water. When, after s years, the salt concentration of the lake decrea considerably, water flow to the low-lying polders differences in head, and to the deep tidal chan by differences in density will become import The groundwater flow below the large enclo dam and the salt diffusion in the groundw beneath the lake will be of minor importance very small volume of fresh groundwater, t mainly present in the top layers of the higher ders, will increase by the intrusion of freshw from the lake into the deeper layers. By making of an approximative assumption about the mi of the water in the lake and by ignoring seas fluctuations and differences between wet and years, simple water and salt balance formulae w obtained, by which it could be shown that l amounts of river water will be required to obta satisfactory decrease of the mean salt concen tion of the lake water. (Knapp-USGS)
W69-09666

AN INTERFACE PROBLEM WITH A SOU AND A SINK IN THE HEAVY FLUID.
Technische Hogeschool, Delft (Netherlands)
A. Verruijt.

ydrol, Vol 8, No 2, p 197-206, June 1969. 10 p, g, 5 ref, append.

scriptors: *Saline water-freshwater interfaces, roundwater movement, Saline water intrusion, del studies, Hydraulic models, Mathematical dels.
ntifiers: Hodographs, Hele-Shaw models.

e hodograph method is explained and used to ve the groundwater flow problem of a source d a sink in the heavy fluid of a 2-fluid system, the ter fluid being stationary. The results of the calations have been verified experimentally by ans of a test in a Hele-Shaw model. (Knapp-GS)
69-09668

NE SAND AND SOIL STRATA IN QUARTER-RY SEDIMENTARY CYCLES OF THE ARON COASTAL PLAIN,
chnion - Israel Inst. of Tech., Haifa. Dept. of ricultural Engineering; and Hebrew Univ., usalem (Israel). Dept. of Agricultural Engineer-

Karmeli, D. H. Yaalon, and Israela Ravina.
ael J Earth-Sci, Vol 17, No 2, p 45-53, Apr 1968. , 3 fig, 4 tab, 18 ref.

scriptors: *Aquifers, *Arid lands, Soils, Sedintation, Dunes, Sands, Aeolian soils, Coasts, position (Sediments), Sedimentary structures, nd erosion.
ntifiers: *Israel.

antitative data of sediment characteristics were tained from cores on Quaternary sandy ridges in Pardes Hanna and Givat Hayyim areas. Conuctional cycles of dune sand accumulation and development were identified. The uniform disbution of fines in the total thickness of the soil atum irrespective of its position on the ridge inates an aeolian origin of the clay and its imdding into the soils by leaching. Topographic difences are the main factor causing the developnt of the different soils. The total amount of es in a soil stratum may be a useful parameter for surface correlations and for estimating the rate aeolian deposition. (Knapp-USGS)
69-09691

ANGES IN THE WATERS OF THE DANUBE GION IN THE BLACK SEA AND THE EFCT ON ANCHOVY BREEDING,
essa State Univ. (USSR). Dept. of Hydrobiolo-

L. El'-Sayed.
nsl by Scripta Technica from Okeanologiya, ad Nauk, SSSR, Vol 8, No 4. Oceanology, Vol 8, 4, p 569-572, 1968. 4 p, 2 fig, 8 ref.

scriptors: *Mixing, *Spawning, *Water temature, Density stratification, Freshwater, Saline ter, Salinity, Limnology, Fish reproduction, eding.
ntifiers: *Anchovy spawning, Danube River, ck Sea.

ree major rivers which discharge water into the thwest part of the Black Sea are the Danube, ieper, and Dniester. The mixing of fresh and ne water produced a visible stratification of er masses. The following water zones were ntified: (1) River water with a salinity of up to 6-; (2) Surficial seawater with a salinity of 12-5% acid; (3) Bottom water with a salinity of 5%. Water samples were collected from the ious water zones during 1966 and 1967 in order establish relationships between temperature, nity, and biological factors. It was concluded t there is a close relationship between salinity, nperature and distribution of spawning anchos in the selected area. The number of anchovy wn was dependent upon the stage of water mix-. The highest number of anchovy spawn was nd in a salinity of 16.7-17.3% and a water temature of 24-26 deg C. The least number was recorded at the mouth of the Danube River where the salinity was between 1-4%. The winds are important in the mixing process and, therefore, in the areal distribution of anchovy spawn. (Carstea-USGS)
W69-09702

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

ION EXCHANGE IS FEASIBLE FOR DESALINATION,
Federal Water Pollution Control Administration, Washington, D.C.
Jacob I. Bregman, and James M. Shackelford.
Environ Sci Tech, Vol 3, No 4, p 336-340, Apr 1969. 5 p, 4 fig.

Descriptors: *Demineralization, *Ion exchange, Dissolved solids, Ions, Saline water, Acids, Alkalis (Bases), Water costs, Economics, pH, *Desalination, *Desalination processes, Water treatment, Water quality, Water chemistry, *Waste water treatment.
Identifiers: Anions, Deionization.

Ion exchange of waste waters having low amounts of total dissolved solids is more economically feasible than chemical regeneration. The recent revival of ion exchange as a desalination process may be attributed to: (1) development of high-capacity ion exchangers for demineralization; (2) development of ingenious techniques for efficient use, recovery, and reuse of resin regenerants; and (3) introduction of exotic, nonresin, ion exchange techniques. New processes using these approaches include the Desal, Sul-bi-Sul, Sirotherm, continuous ion exchange, and liquid ion exchange. Each process is discussed separately. The liquid ion exchange process is particularly adaptable to the removal of magnesium because the system can be made highly selective for that ion. The continuous ion exchange process may be installed for 20% less cost than conventional bed units and requires about one-third less space. One such unit costs $0.10/1000 gal for producing water with 2 ppm total dissolved solids from water containing 250 ppm total dissolved solids. (USBR)
W69-09527

SOLVENT STABILITY AND RECOVERY IN SOLVENT EXTRACTION DESALINATION,
Texas A and M Univ., College Station.
R. R. Davison, and W. H. Smith.
Office Saline Water Res and Develop Progr Rep No 371, Aug 1968. 64 p, 14 fig, 13 tab, 15 ref. OSW Contract 14-01-0001-1180.

Descriptors: *Solvent extractions, *Desalination processes, *Analytical techniques, Ion exchange, Distillation, Gas chromatography, Solvents, Stability, Water temperature, Ozone, Oxygen, Nitrogen, Indicators, Volumetric analysis.
Identifiers: Solvent stability, Amine extraction, Amine analysis.

Studies were undertaken to determine the chemical stability of amine solvents which are used in desalination of seawater, and methods of amine removal from the resulting freshwater. Five secondary and tertiary amines C5 and C6, purified by distillation, were used as experimental materials. The effects of temperature, oxygen, nitrogen, and amine-water mixtures upon stability of selected amines were studied. The degradation of amines was measured by water solubility or cloud points and by gas chromatography. It was concluded that the degradation of amines at 60 deg C was higher than at room temperature. Further, degradation was higher in the presence of oxygen than nitrogen. Therefore, a decrease in oxygen in the system will result in a decrease of amine degradation. The removal of amine solvents from water was investigated by steam stripping, biological methods, ion exchange and ozonation. Trickle filters were found suitable for removal of amine residues, but yeasts, molds and algae apparently reduced the effectiveness of the filters. Laboratory experiments showed that distillation was very effective in amine removal and the process was not pH dependent. However, a few ppm of amine hydrochloride may remain in the product. The ozonation method was neither efficient nor economical. In contrast, the ion exchange method appears to be very effective and economical for removing amines from water. A buffered bromcresol green reagent method used for amine analysis in water is discussed. (Carstea-USGS)
W69-09692

3B. Water Yield Improvement

TIMING OF THE APPARENT EFFECTS OF CLOUD SEEDING,
California Univ., Berkeley. Statistical Lab.
Jeanne L. Lovasich, Jerzy Neyman, Elizabeth L. Scott, and Jerome A. Smith.
Science, Vol 165, No 3896, p 892-893, Aug 29, 1969. 2 p, 1 fig, 1 tab, 7 ref.

Descriptors: *Cloud seeding, *Artificial precipitation, *California, Rainfall, Rain gages, Precipitation (Atmospheric), Temperature, Evaporation, Convection, Weather modification, Water yield.
Identifiers: Cloud seeding effects.

The average hourly precipitation amounts, on 96 experimental days without cloud seeding in the Whitetop experiment, California, show a marked maximum between 4 and 7 o'clock in the afternoon, presumable reflecting the convection activity caused by heating of the ground occurring during an earlier period. No such maximum is observed on the 102 days with seeding. The hypothetical explanation presupposes that seeding with silver iodide creates early general cloudiness, which prevents ground temperatures from rising to levels usually attained on days without seeding. This hypothesis may explain not only the mechanism of the loss of rain in the Whitetop experiment, apparently induced by seeding, but also may explain certain phenomena noticed in another experiment. (Knapp-USGS)
W69-09451

PERFORMANCE OF AN ATMOSPHERIC WATER RESOURCES RESEARCH PROGRAM IN THE HUNGRY HORSE AREA, MONTANA, 1967-68 SEASON.

N Amer Weather Consult, Goleta, Calif, Rep No 97, Nov 1968. 51 p, 14 fig, 10 tab, 7 ref, 2 append.

Descriptors: Atmospheric precipitation, *Cloud seeding, *Snowfall, Benefit-cost ratios, Economics, Storms, Meteorology, Montana, Snowpacks, Streamflow, Temperature, Silver iodide, Runoff, Snowmelt, Performance, Snow, *Weather modification, *Artificial precipitation.
Identifiers: *Atmospheric research, Water content, Kalispell (Mont), Ice nuclei.

Hungry Horse Project is one of the first operational adaptation research projects undertaken as part of the Bureau of Reclamation's Atmospheric Water Resources Program. Hungry Horse Basin, in northwestern Montana, was chosen for such a program because of potential high economic yields from small increases in precipitation over this basin. Seeding operations performed from Oct 1967 through Apr 1968 are discussed. Results of the program are evaluated in terms of streamflow, snowpack water content, analysis of silver content in snow, and investigation of nuclei climatology. Equipment design and construction, functional requirements of each general type of station, and overall system functional capabilities are enumerated. (USBR)
W69-09543

CALIBRATING A WATERSHED BY USING A CLIMATIC DATA,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 02A.
W69-09759

A METHOD OF ESTIMATING STREAMFLOW LOSS BY EVAPOTRANSPIRATION FROM THE RIPARIAN ZONE,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 02D.
W69-09760

BALTIMORE'S WATERSHEDS: AN EXAMPLE OF INTEGRATED LAND USE,
Forest Service (USDA), Washington, D.C. Div. of Watershed, Recreation, and Range Research; and Bureau of Water Supply, Baltimore, Md.
For primary bibliographic entry see Field 04C.
W69-09761

WILL THE USE OF 2,4,5-T TO CONTROL STREAMSIDE VEGETATION CONTAMINATE PUBLIC WATER SUPPLIES,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station; Pennsylvania State Univ., University Park, Pa.; and Amchem Products, Inc., Ambler, Pa.
For primary bibliographic entry see Field 05B.
W69-09763

3C. Use of Water of Impaired Quality

STANDS FOR AUTOMATION ACHIEVED BY SPRINKLING,
California Univ., Davis.
For primary bibliographic entry see Field 03F.
W69-09655

3D. Conservation in Domestic and Municipal Use

CONSERVATION DISTRICT ACT.

Ill Ann Stat ch 57 1/2, secs 101-121 (Smith-Hurd Supp 1969).

Descriptors: *Illinois, *Conservation, *Land management, *Administrative agencies, Land resources, Natural resources, Legislation, Financing, Legal aspects, Water law, Project purposes, Recreation, Administration, Wildlife, Wildlife conservation, Habitats, Project planning, Projects, Resource development.
Identifiers: *Conservation districts.

On petition of the voters of a county not organized as a forest preserve district, a conservation district may be formed to promote the conservation of nature, flora and faunna, natural environment, and natural resources of the district. The district's management shall consist of five trustees who serve a five year term. The State Conservation Department shall guide and consult with every district in matters relating to conservation and recreation policies and plans. Every district has the power to enter into contracts; acquire real property; make and publish ordinances; and study the district's wildland and other open space resources with respect to preservation of such resources. Each district is to be financed by an annual levy of taxes on property within its jurisdiction, and when necessary bonds may be issued. (Johnson-Fla)
W69-09626

3F. Conservation in Agriculture

MICROMETEOROLOGICAL METHODS AS TOOLS FOR INCREASING CROP PRODUCTION AND WATER-USE EFFICIENCY,
Agricultural Research Service, Kimberly, Idaho. Snake River Research Center.
James L. Wright.
Pap, Proc Eighteenth Annu Fertilizer Conf Pac Northwest, Twin Falls, Idaho, July 1967. 8 p, 11 ref.

Descriptors: *Crops, *Crop production, *Agronomic crops, Efficiencies, Water utilization, *Micrometeorology, *Meteorology, Microclimatology, Evaporation, Microenvironment, *Irrigation practices, Water management (Applied), *Agronomy, Irrigation efficiency, Plants, Energy balance, Agriculture, Farm management, Environment, Irrigation.

Application of micrometeorological methods to problems of agronomic importance has increased the understanding of physical processes controlling the natural environment of plants. Methods and the basic information gained from using these methods illustrate the importance of microclimatic factors and indicate the applicability to problems of practical importance. Results of micrometeorological studies have increased our understanding of such things as partitioning energy at the surface of the earth, factors controlling the rate of evaporation of water from the surface of the earth, and effects of management practices upon the microclimate of a plant community. A deeper understanding of these basic factors increases the possibility of obtaining (1) more efficient use of water, (2) greater and more economical crop production through improved irrigation management practices, (3) modification of the natural microclimate of a crop, and (4) development of improved crop types that will maximize the beneficial factors of the microclimate. (USBR)
W69-09528

TRAPEZOIDAL FLUMES FOR MEASURING FLOW IN IRRIGATION CHANNELS,
Agricultural Research Service, Kimberly, Idaho.
For primary bibliographic entry see Field 07B.
W69-09532

SALT BALANCE, IRRIGATION EFFICIENCY, AND DRAINAGE DESIGN,
Herman Bouwer.
Proc Amer Soc Civ Eng, J Irrig Drain Div, Vol 95, No IR1, p 153-170, Mar 1969. 18 p, 4 fig, 3 tab, 27 ref, 2 append.

Descriptors: *Salt balance, *Irrigation efficiency, Salts, Irrigation, *Drainage engineering, *Drainage systems, Drainage, Evapotranspiration, Irrigation systems, Leaching, Saline soils, Salinity, Water utilization, Water table, Root zone, Crops, Water requirements, Consumptive use, Salt tolerance, Time, Bibliographies.
Identifiers: Irrigation requirement, Salt removal.

A simplified procedure is presented to predict the amount of irrigation water necessary (in addition to that for evapotranspiration) to maintain salt balance in the root zone. Key factor in the procedure is the leaching efficiency, ranging from 0.2 for fine-textured soils to 0.6 for coarse-textured soils. Also taken into account are the salt tolerance of the crop, salt concentration of the irrigation water, and evapotranspiration. The procedure predicted accurately the known leaching requirements for salt balance of 3 irrigated regions. In defining irrigation efficiency, distinction is made between an efficiency of water utilization and an efficiency of water application. Drainage flow from the root zone decreases after irrigation. The water table response of a system of parallel drains to this flow can be computed for the design of a drainage system to avoid high water tables. (USBR)
W69-09544

TRANSIENT FUNCTIONS FOR LA DRAINAGE,
Utah State Univ., Logan. Dept. of Agricultural Irrigation Engineering.
For primary bibliographic entry see Field 02F.
W69-09654

STANDS FOR AUTOMATION ACHIEVED SPRINKLING,
California Univ., Davis.
Frank E. Robinson.
ASCE Proc, J Irrig and Drainage Div, Vol 95, IR3, Pap 6774, p 385-389, Sept 1969. 5 p, 3 tab, ref.

Descriptors: *Irrigation design, *Irrigation syste *Sprinkler irrigation, Saline soils, Soil conser tion, Water utilization, Automation.
Identifiers: *Sprinkler irrigation benefits, Agric tural automation.

Solid set sprinkler systems applying water at proximately 0.1 inch per hr showed improvem over conventional surface irrigation. By prevent surface salt accumulation, increasing crop em gence, saving water, maintaining soil tilth, incre ing land use efficiency, and reducing labor requ ments, sprinkler irrigation has become essential the mechanization and automation of de agriculture. (Knapp-USGS)
W69-09655

INDIANA AGRICULTURAL IRRIGATION 1967,
Indiana Dept. of Natur Resources, Indianapo Water Planning Section; and Purdue Un Lafayette, Ind. Agriculture Extension Service.
Kenneth Kemp, James O. Russell, Jerry V. Mannering, Dan Wiersma, and Donald R. Sisson.
Indiana Dep Natur Resources Irrig Rep, May 19 27 p, 1 fig, 4 tab, 7 ref, 3 append.

Descriptors: *Irrigation, *Indiana, *Consumpt use, *Surveys, *Data collections, Water utilizat Irrigation water, Water sources, Water supply, rigation practices, Water management (Applied
Identifiers: Indiana irrigation.

A study was made to determine the irrigated a and amount of irrigation water used in Indiana rigation is used in 90% of the counties in the St and irrigation is the largest consumptive use water in Indiana. The total irrigated area in 19 was 30,373 acre-ft, on which 26,178 acre-ft water was applied. The number of irrigators, rigated acreage, type of irrigation, and water c sumed are tabulated. (Knapp-USGS)
W69-09680

HUMBOLDT RIVER STUDIES,
Nevada Univ., Reno. Desert Research Inst.
For primary bibliographic entry see Field 04B.
W69-09724

A COMPOSITE VARIABLE FOR ESTIMATI THE PRODUCTIVITY OF IRRIGATI WATER,
Hawaii Univ., Honolulu. Water Resour Research Center.
Howard C. Hogg, Jack R. Davidson, and Lloyd E Rankine.
p 95-107 in Water Resources Research Cent bound volume of Collected Reprints, Vol Proceedings of the Committee on Economics Water Resources Development of the West Agricultural Economics Research Council, D 1967, Rpt No 16. p 25-35, 1968. 7 ref. OWRR P A-012-HI.

Descriptors: *Composite variable, *Water prod tion function, *Water-balance function, Effect pan factor, Irrigation, Sugar cane, Effective r fall, Potential evapotranspiration, Soil-moistu storage, Actual evapotranspiration, Annual evaporation demand, Moisture stress.

omposite variable for estimating a water yield tionship was first developed then shown to k well in the case of sugar cane. The applicabili- f the procedure to other crops grown in other ducing areas is undetermined. However, it ap- rs promising for several other crops. The fol- ing data are required to estimate the variable: evaporation, rainfall, soil moisture storage, nber of irrigation rounds, and the relationship ween consumption use and pan evaporation for crop being considered.
9-09736

IGATION COMPANIES.
Stat Ann secs 35-1201 thru 35-1209 (1962).

criptors: *Irrigation programs, *Arkansas, *Ir- tion, *Operation and maintenance, Eminent ain, Legal aspects, Condemnation, Irrigation als, Irrigation ditches, Drains, Conveyance ctures, Aqueducts, Dams, Water conveyance, es, Structures, Compensation, Rivers, Lakes, al construction, Bridge construction, Bridges, ht-of-way, Easements, Legislation.
ntifiers: Corporations.

corporations organized for the purpose of nishing water to the public for irrigation of any ds or crops are authorized to exercise the right eminent domain when necessary to accomplish h purpose. Such corporations may draw water n any river, lake, or creek when necessary and general may do any act necessary or convenient ccomplishing the purpose of this act. Guidelines set out for the surveying of contemplated lines construction. When any irrigation company con- cts its canals, ditches, conduits, aqueducts, elines, or any of its works across a public road, it equired to build a sufficient bridge across such truction. Water shall be supplied at equitable es to the owners of all lands adjacent to any al constructed or operated by any irrigation npany. (Keith-Fla)
9-09781

. WATER QUANTITY MANAGEMENT AND CONTROL

. Control of Water on the Surface

NITARY AND DRAINAGE COMMISSIONS.
Code Ann secs 18-101 thru 18-110 (1962).

scriptors: *South Carolina, *Drainage, rainage districts, *Drainage programs, Legisla- n, Administrative agencies, Cities, Political ects, Public utilities, Drains, Canals, Ditches, lverts, Roads, Engineers, Surveys, Maps, Con- nnation, Adjudication procedure.
ntifiers: Counties, Agricultural drainage.

e Governor upon request of the senator and resentatives of any county, may appoint mem- s of the Sanitary and Drainage Commission for county. The Commission shall function in sani- y drainage, public utility drainage and agricul- al drainage. The duties and powers of every nmission shall be to: (1) have control over ins; (2) make surveys; (3) make alterations, im- vements and additions to drainage works; (4) npel drains to be kept in good order; (5) require sons to dig and open drains or ditches; (6) util- the county chain gang; (7) do all work for inage purposes; (8) prepare estimates; and (9) demn lands. The commission may recover ex- ses (in an action brought in the court of com- n pleas) from any person who refused to comply h their order. Subsequent purchasers of land ding work by the commission shall be liable for enses and charges paid or incurred by the com- ssion. (Shevin-Fla)
9-09458

A NOTE ON MORAN'S PROBABILITY THEORY OF DAMS AND STORAGE SYSTEMS,
City Univ., London (England).
C. Venetis.
Water Resources Res, Vol 5, No 3, p 884-887, Aug 1969. 4 p, 2 fig, 2 ref.

Descriptors: *Reservoir operation, *Water storage, *Reservoir yield, *Probability, Reservoir design, Streamflow forecasting.
Identifiers: Moran's theory (Reservoirs).

The distribution of the reservoir content is examined in discrete time and continuous state space for constant release. Empty and full reservoir probabilities are expressed by the Dirac delta function. The distribution of the reservoir content is obtained by convolution, taking into account the constraints in the range of variation of the content of the finite reservoir that may not meet the demand. The case of nonzero probabilities of zero inflows is briefly discussed, and the equations for the discrete case are derived from those of the continuous by substituting summations for the integrals. (Knapp-USGS)
W69-09470

SOME EFFECTS OF MAN-MADE CONTROLS IN THE UPPER REACHES OF A SMALL DRAINAGE BASIN,
Mississippi State Univ., State College. Dept. of Civil Engineering; and Mississippi State Univ., State College. Water Resources Research Inst.
Adnan Shindala, and Melville S. Priest.
Water Resources Bull, Vol 5, No 2, p 3-9, June 1969. 7 p, 5 fig, 1 ref. OWRR Proj A-023-MISS.

Descriptors: *Watershed management, *Flood control, *Reservoir operation, *Channel morphology, Width, Erosion, Floods, Streamflow, Cross-sections, Profiles, Peak discharge.
Identifiers: Watershed management effects.

Governmental agencies have been instrumental in the construction of numerous dams and other control structures in the small watersheds of the State of Mississippi. Although some of the consequences are predictable, there are some effects which are not yet well defined. The physical effects of such works on a particular stream and its channel are described. As was anticipated, peak discharges appear to have been somewhat reduced. Changes in channel cross-section depend, to some extent, upon location along the stream. However, there appears to have been a narrowing of the channel in that portion of the stream for which cross-sections were available. (Knapp-USGS)
W69-09491

FLOOD PLAIN INFORMATION, EAST FORK WHITE RIVER AND TRIBUTARIES, VICINITY OF COLUMBUS, INDIANA.
Corps of Engineers, Louisville, Ky.

Corps Eng Flood Plain Rep, Dec 1968. 45 p, 9 fig, 21 plate, 14 tab.

Descriptors: *Floods, *Flood damage, *Indiana, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Columbus (Indiana), White River, Standard project flood, Intermediate regional flood.

Flooding of the East Fork White River, Columbus, Indiana is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-09496

FLOOD PLAIN INFORMATION-COASTAL FLOODING AT HAMPTON, VIRGINIA.
Corps of Engineers, Norfolk, Va.

Corps Eng Flood Plain Rep, Oct 1968. 31 p, 5 fig, 6 plate, 2 tab.

Descriptors: *Floods, *Flood damage, *Virginia, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Hampton (Va), Standard project flood, Intermediate regional flood.

Flooding of the Hampton, Virginia coastal area is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-09497

WATER LAW--THE RISE AND FALL OF NEW MEXICO'S TEMPLETON DOCTRINE,
For primary bibliographic entry see Field 06E.
W69-09562

RIVERS AND CREEKS.
For primary bibliographic entry see Field 06E.
W69-09585

BRINKLEY V EATON (RESPONSIBILITY FOR NATURAL ALTERATION OF FLOW).
For primary bibliographic entry see Field 06E.
W69-09586

WATER AND SEWERS.
For primary bibliographic entry see Field 06E.
W69-09589

DRAINAGE DISTRICTS.
For primary bibliographic entry see Field 06E.
W69-09590

DRAINAGE DISTRICTS.
For primary bibliographic entry see Field 06E.
W69-09591

DRAINAGE DISTRICTS.
For primary bibliographic entry see Field 06E.
W69-09592

DRAINAGE DISTRICTS.
For primary bibliographic entry see Field 06E.
W69-09593

DRAINAGE DISTRICTS.
For primary bibliographic entry see Field 06E.
W69-09594

SOIL CONSERVATION DISTRICTS PROJECTS.
For primary bibliographic entry see Field 06E.
W69-09603

STATE DAMS, RESERVOIRS AND OTHER WATER CONSERVATION PROJECTS.
For primary bibliographic entry see Field 06E.
W69-09604

STATE DAMS, RESERVOIRS AND OTHER WATER CONSERVATION PROJECTS.
For primary bibliographic entry see Field 06E.
W69-09605

STATE DAMS, RESERVOIRS AND OTHER WATER CONSERVATION PROJECTS.
For primary bibliographic entry see Field 06E.
W69-09606

STATE DAMS, RESERVOIRS AND OTHER WATER CONSERVATION PROJECTS.
For primary bibliographic entry see Field 06E.
W69-09607

STATE DAMS, RESERVOIRS AND OTHER WATER CONSERVATION PROJECTS.
For primary bibliographic entry see Field 06E.
W69-09608

MUNICIPAL AND COUNTY GOVERNMENT (WATER WORKS).
For primary bibliographic entry see Field 06E.
W69-09617

WATER SUPPLY FACILITIES; FLOOD CONTROL; WATER MANAGEMENT.
For primary bibliographic entry see Field 06E.
W69-09619

CANALS AND WATERWAYS.
For primary bibliographic entry see Field 06E.
W69-09620

CHICAGO REGIONAL PORT DISTRICT.
For primary bibliographic entry see Field 06E.
W69-09621

REGULATING AND MEASURING WATER-POWER.
For primary bibliographic entry see Field 06E.
W69-09623

CONTRACTS BY CITIES WITH UNITED STATES REGARDING FLOOD CONTROL PROJECTS.
For primary bibliographic entry see Field 06E.
W69-09627

INTERSTATE DRAINAGE DISTRICTS.
For primary bibliographic entry see Field 06E.
W69-09628

DRAINAGE DISTRICTS IN CONNECTION WITH UNITED STATES LEVEES.
For primary bibliographic entry see Field 06E.
W69-09629

TRUSTEE MANAGEMENT OF DRAINAGE OR LEVEE DISTRICTS.
For primary bibliographic entry see Field 06E.
W69-09630

LEVEE AND DRAINAGE DISTRICTS.
For primary bibliographic entry see Field 06E.
W69-09632

CONSTRUCTION AND MAINTENANCE OF BRIDGES AND CULVERTS.
For primary bibliographic entry see Field 06E.
W69-09635

WATER-POWER IMPROVEMENTS.
For primary bibliographic entry see Field 06E.
W69-09638

ADMINISTRATION - HIGHWAYS - DRAINAGE.
For primary bibliographic entry see Field 06E.
W69-09639

INTERSTATE BRIDGES (ADDITIONAL ACT).
For primary bibliographic entry see Field 06E.
W69-09644

EXERCISE OF EMINENT DOMAIN BY CITIES FOR CONSTRUCTION OF WATERWORKS AND WATER PIPE LINES.
For primary bibliographic entry see Field 06E.
W69-09645

FLOODS ALONG LITTLE CALUMET RIVER AND TRIBUTARIES, ILLINOIS AND INDIANA.
Corps of Engineers, Chicago, Ill.

Corps Eng Flood Plain Inform Brochure, 1969. 1 sheet, text, 6 fig, 14 photo, 2 map.

Descriptors: *Floods, *Flood damage, *Illinois, *Indiana, Floodplains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Little Calumet River (Ill-Ind), Standard project flood, Intermediate regional flood.

Flooding of the Little Calumet River, Illinois and Indiana is described in a report of floodplain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections in a 1-sheet flood potential report indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of floodplain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-09689

SOME CHARACTERISTICS OF VEGETATION DEVELOPMENT IN THE FLOODPLAIN OF OB RIVER IN THE TAIGA ZONE (RUSSIAN),
Leningrad State Univ. (USSR).
For primary bibliographic entry see Field 02I.
W69-09700

CONTROL OF TEMPERATURES OF WATER DISCHARGED FROM A MULTIPLE-PURPOSE RESERVOIR,
Corps of Engineers, Vicksburg, Miss.
J. B. Middleton.
Reservoir Fish Resources Symp, Georgia Univ, Apr 5-7, 1967, p 37-46, 1967. 10 p, 5 fig.

Descriptors: *Temperature control, *Reservoir design, Multiple-purpose reservoirs, *Reservoir operation, *Stream fisheries, Reservoir construction, Water temperature, Intake structures.
Identifiers: Stream fisheries conservation.

The control of temperatures of water discharged from multiple-purpose reservoirs is now accepted as one of the goals of the reservoir planner in those cases where this is necessary to avoid damage to downstream fisheries. The planning and design of DeGray Reservoir on the Caddo River in south-central Arkansas was coordinated with interested agencies from the earliest stages. From this planning has evolved a design of an intake structure which may be utilized to control, within a wide range, the elevations from which discharges are withdrawn. This feature, together with a downstream regulating dam, is expected to make practical the preservation of the existing downstream fishery. (Carstea-USGS)
W69-09706

OPERATIONAL PROBLEMS ASSOCIATED WITH A BASIN RESERVOIR SYSTEM,
Corps of Engineers, Omaha, Nebr. Missouri River Div.
Donald C. Bondurant, and Robert H. Livesey.
Reservoir Fish Resources Symp, Georgia Univ, April 5-7, 1967, p 47-55, 1967. 9 p, 1 fig, 2 tab.

Descriptors: *Reservoir operation, *Miss
River, *Water management (Applied), *W
resources, Watershed management, Irrigat
Reservoir storage, Navigation, Flood cont
Water supply, Hydroelectric power, Reser
fisheries.
Identifiers: *Missouri River reservoir system.

Most operational reservoirs in the United St
have no specific provisions for fish and wild
conservation. However, the operation of the e
ing reservoirs can be such as to improve fish
wildlife and recreational benefits. The 6 m
reservoirs on the Missouri River are prima
designed for flood control, irrigation, hydroelec
power and navigation. The main decision-mak
steps to best accommodate as many interests
possible are described. Research studies were
dertaken at Gavins Point and Oahe to learn m
about the characteristics of fish reproduction
function of hydrologic environment. (Carn
USGS)
W69-09707

**TRACING STORM AND BASE FLOW TO VA
ABLE SOURCE AREAS ON FORESTED HE
WATERS,**
Georgia Univ., Athens. School of Fo
Resources.
John D. Hewlett.
School of Forest Resources, University of Geor
Athens, Georgia, Aug 1969. 21 p, 7 ref. OW
Project A-004-GA.

Descriptors: *Base flow, *Surface-groundwa
relationships, *Soil moisture content, *Forest so
*Interfluves, *Aquifers, *Groundwater movem
*Groundwater recharge, Runoff forecasting, P
colating waters, Surface waters, Groundwa
basins, Streamflow, Watersheds, Infiltration, I
tribution patterns, Hydrogeology, Organic wa
matter, Georgia, Southeast U.S.
Identifiers: Piedmont Province, Variable sou
areas, Sherman-Hortonian unit hydrograph.

Objectives of the project were to apply the varia
source area concept of headwater hydrology
replacement of the Sherman-Hortonian theories
runoff; to measure the organic and inorganic de
product by a forested catchment and to trace
debris to its source; to provide a teaching aid to
prove the instruction of student land managers;
to secure a few years of high-quality precipitat
and streamflow data from a forested Piedm
Province watershed. Fifty-five storm hydrogra
together with detailed observations on rainfall,
moisture and groundwater levels, were analyze
the light of the variable source area concept fo
60-acre forested watershed in the Piedm
Province in Georgia. Behavior of streamflow
hypothesized by the variable source area conc
and as verified by measured changes in soil wa
content with depth and along the slope is su
marized on a cross-section through a headwa
stream. The variable source area provides all of
storm flow and much of the base flow betw
storms, and the main aquifer under the interflu
provides a relatively stable portion of base fl
Methodology and evaluation of the findings
contained in an MA thesis by William P. Neal e
tled, 'The Southern Piedmont Upland of
Southeastern United States: A Geomorphic Syst
in a Steady State of Dynamic Equilibrium', an
PhD dissertation by Wilhelm G. Tischendorf e
tled, 'Tracing Stormflow to Variable Source Ar
in a Small Forested Watershed in the Southeast
Piedmont'. (Conway-Ga Inst of Tech)
W69-09720

**TRACING STORMFLOW TO VARYI
SOURCE AREAS IN A SMALL, FOREST
WATERSHED IN THE SOUTHEASTERN PI
MONT,**
Georgia Univ., Athens. School of Fo
Resources.
Wilhelm G. Tischendorf.
Ph.D. Thesis, Univ of Ga, 1969. 114 p.

scriptors: *Water sources, *Storm runoff, *Subface runoff, Soil water movement.
ntifiers: Variable source area.

e existence and areal extent of subsurface stormw was studied on a 60-acre forested watershed in Georgia Piedmont. Between January 1967 and rch 1968, 14,519 moisture readings were obned from 42 sites on the watershed. To a maxum depth of 20 feet below the soil surface. drographs were separated into stormflow and eflow by a standardized slope of 0.05 csm/hr. m 55 rain storms during the study period, 36 l stormflow volumes equal to channel precipitan, with no evidence of overland flow. Stormflow l channel expansion sometimes continued after nfall had ended. During larger storms, lateral surface flow caused a rapid rise of the groundter table only in the vicinity of the perennial ing heads. Elsewhere the groundwater table, at ths greater than 30 feet, showed only seasonal ctuations up to 3 feet with maximum levels in y. The annual moisture cycle in the soil exssed itself as a sine curve down to 20 feet depth. ximum moisture constant was reached in March he top 3 feet, and in June at 12 feet in the soil ntle. The upper 3 feet showed the most imdiate response to rainfall. Soil moisture concenions below 3 feet lagged in their response. At 12 t this lag was 3 months. Rapid vertical flow of isture cannot be assumed under such condis. Increase in moisture after rain in the upper 3 t of soil was greater as distance from the channel reased indicating that rain was stored upslope released down slope. With lack of rapid vertical colation downward through the soil mantle, er must have drained laterally from the lower tions of the slope. Therefore, contribution of surface flow to direct runoff decreased with ance from the channel, and was detectable by iodic soil moisture measurement only in the er 3 feet of the soil mantle. Direct runoff mes from the seven largest storms varied from 30 per cent of gross precipitation; the average centage from all storms was 8 per cent of gross cipitation. The study was a unique analysis of variability of the source area for stormflow on entire watershed, proving that the variable rce area concept is a valid representation of the infall-runoff relation.
9-09740

LTIMORE'S WATERSHEDS: AN EXAMPLE INTEGRATED LAND USE,
rest Service (USDA), Washington, D.C. Div. of tershed, Recreation, and Range Research; and eau of Water Supply, Baltimore, Md.
primary bibliographic entry see Field 04C.
9-09761

OT PLANNING STUDY FOR AREA WIDE RM DRAINAGE PLANNING.
ght-McLaughlin Engineers, Denver, Colo.

t Planning Study for Area Wide Storm nage Planning, Volume II, April 1969. 76 p, 3 14 tab.

criptors: *Planning, *Water management (Appl), *Flood control, *Drainage, Drainage ms, Flood plain zoning, Methodology, Estied costs, Legal aspects, Multiple-purpose pro, Regional analysis, Hydrograph analysis, Unit ograph, Detention reservoirs, Channels, Con.
tifiers: *Boulder (Colo), *North Boulder o), *Environmental design.

pilot planning study includes the development methodology for the preparation of an area storm drainage plan, a study of alternate solu to the North Boulder, Colorado major age problems, preparation of storm drainage er plans for five North Boulder waterways, lopment of a financing strategy and a practical of the recently completed Urban Storm nage Criteria Manual. North Boulder was en as a pilot study because it represented most of the urban drainage problems found in the Denver region and because it had no flood plain management program, policy, or regulation ordinances. The problem was defined hydrologically and hydraulically by field and office studies to develop all practical alternates and to study these alternates using a qualified environmental design team approach. Economics, comprehensive plans and programs of the city and county, open space needs, greenbelt requirements, and legal aspects of urban storm drainage were all taken into consideration when evaluating alternates. A detailed discussion of the Colorado Urban Hydrograph Procedure, which was used in determining flood magnitudes was given. The report is contained in two volumes: Volume one contains the text of the report and Volume two contains thirty detailed drawings of the proposed Wonderland Creek Drainage. (Marriott-Chicago)
W69-09774

CUTTING TIMBER ON SWAMPS AND OVERFLOWED LANDS.

Ark Stat Ann sec 10-301 (1956).

Descriptors: *Arkansas, *Lumbering, *Swamps, *Forest management, Lumber, Legislation, Legal aspects, Federal government.
Identifiers: Penalties (Criminal).

It is unlawful to cut, destroy or remove any timber standing on any of the swamp and overflowed lands granted by Congress to the state. Criminal penalties are provided for violation of the foregoing provision. Any person who resides on such swamp or overflowed lands may cut timber growing on the tract which he occupies for his own use for building or farming purposes. (Keith-Fla)
W69-09778

SALE OF SWAMP AND OVERFLOWED LANDS.

Ark Stat Ann 10-801 thru 10-807 (1956).

Descriptors: *Arkansas, *Swamps, Legislation, Legal aspects, Wetlands, Appraisals, Administrative agencies, Federal government, Adoption of practices, Boundaries (Property), Beds.
Identifiers: *Overflowed lands.

The commissioner of state lands is authorized to sell lands granted by Congress to the state under the designation 'Swamp and Overflowed Lands.' On application to purchase any such lands, the commissioner will determine whether or not the land is wild and unimproved. If the land is found to be wild and unimproved, then it will be appraised. The method for price determination of such land is specified for different classes of purchasers. It is provided that money from sales be credited to the swamp land fund. Provision is made for the handling of conflicting claims. (Keith-Fla)
W69-09779

AUTHORITY OF CITIES TO OPERATE HARBORS AND PORTS; CREATION OF PORT AUTHORITIES.

Ark Stat Ann secs 19-2701 thru 19-2748 (1968).

Descriptors: *Arkansas, *Port authorities, *Administration, *Structures, Legislation, Legal aspects, Cities, Harbors, Eminent domain, Condemnation, Financing, Right-of-way, Bridges, Multiple-purpose projects, Administrative agencies, Levees, Docks, Piers, Construction, Maintenance, Navigation.
Identifiers: Riparian terminals.

Cities are authorized to establish, construct, and regulate landing places, levees, wharves, docks, piers, and basins for the proper regulation of the navigation, trade, or commerce of such city. Cities may also purchase, construct, and operate any ports, harbors, river-rail terminals, barge terminals, or any other structures convenient to the carrying on of commerce. Cities may create port authorities to carry out the foregoing powers. Any of the foregoing structures or property for the construction thereof may be acquired by the city through exercise of the power of eminent domain. Specific provisions indicate how the acquisition or construction of any of the foregoing structures is to be financed. The general purposes for which port authorities may be created are enumerated as are the powers of such authorities. Any combination of cities and counties in or out of the state may exercise the foregoing powers for the purposes aforementioned. Special methods of financing are provided for such joint efforts. (Keith-Fla)
W69-09780

DAMAGE TO WATER, FLOOD CONTROL STRUCTURES, OR FISH.
For primary bibliographic entry see Field 05G.
W69-09782

HIGHWAYS.

Ark Stat Ann sec 76-1518 (1958).

Descriptors: *Arkansas, *Bridge construction, *Navigable rivers, *Administrative agencies, Streams, Legislation, Highways, Local governments, Bridges.

When any county is to build a highway bridge across a navigable stream which is over four hundred feet in width, it shall be the duty of the County Court to appoint a commission of two competent property holders and taxpayers of said county, who in conjunction with the County Judge shall constitute a Board of Commissioners. The Board's duty shall be to locate said bridge and to give notice by publication of readiness to receive plans, specifications, and bids for the erection of said bridge. (Marsee-Fla)
W69-09783

CROSSING BY STATE HIGHWAYS OF WATERCOURSES.
Del Code Ann tit 17, sec 707 (1953), as amended, (Supp 1966).

Descriptors: *Delaware, *Navigable waters, *Highways, *Navigation, Administrative agencies, Roads, Civil engineering, Road construction, Highway relocation, Transportation, Right-of-way, Railroads, Rivers, Streams, Canals, Legislation, Surveys.

The State Highway Department may cross any canal, navigable stream or watercourse with a state highway but only in such a manner as to not unnecessarily impede the navigation and use thereof. The Department may enter upon the land or waters of any person to make any surveys for the proposed highways. (Helwig-Fla)
W69-09788

STAUFFACHER V CITY OF SUN PRAIRIE (RIGHTS TO A DRAINAGE EASEMENT).
168 NW 2d 587-588 (Wis 1969).

Descriptors: *Wisconsin, *Drainage, *Easements, *Assessments, Legal aspects, Judicial decisions, Storm drains, Cities, Ditches, Drainage water, Sewers, Contracts, Damages, Construction, Construction costs, Maintenance, Maintenance costs, Operation and maintenance, Local government, Water conveyance, Waste water disposal.
Identifiers: Injunction (Prohibitory).

Plaintiff's predecessors in title made an agreement with the defendant concerning a drainage easement. Plaintiff alleged that the easement was granted upon the condition that the defendant would not assess the landholders or their heirs or assigns, the plaintiffs, for any improvements made

to the drainage ditch. The defendant assessed plaintiff's land for sewer construction and plaintiff sought injunctive relief. The trial court dismissed the complaint holding that the covenant only prohibited an assessment for a ditch and not one for a sewer and thus had not been violated by defendant. The trial court also held that the defendant had no power to acquire an easement for public purposes by freeing the abutting land from an assessment for the construction of the easement. On appeal the court agreed with the trial court's determination that the easement was for a drainage ditch and not a sewer line. However, they disagreed with the lower court's conclusion respecting the defendant's ability to acquire the easement and reversed the judgment with leave for plaintiffs to amend. (Shevin-Fla)
W69-09790

RIVER FRONT IMPROVEMENT COMMISSION.

Iowa Code Ann secs 372.1-372.17 (1949), as amended, (Supp 1969), sec 372.18 (Supp 1969).

Descriptors: *Administrative agencies, *Rivers, *Planning, *Iowa, Wharves, Riparian rights, River beds, City planning, Dams, Construction, Legislation, Meanders, Streams, Taxes, Financing, Beds, Ownership of beds, Regulation, Flood control, Water resources development, River regulation, Dams, Cities.
Identifiers: *Title, *Improvements.

Five hundred electors in certain specified classes of cities may petition the governor to appoint a river-front improvement commission. Title to streams shall vest in the commission to the extent that such streams border on or are included within the city. Title to the beds of these streams remains in the state, and riparian rights are not effected. Title to non-meandered streams may be acquired by purchase or condemnation. The commission may: redeem lands between meandered lines or lands in the channel of any stream that is not meandered; construct, regulate and maintain dams; and provide for a channel adequate to carry flood waters. The commission may adopt plans: for the improvement of such river channel and banks; reclaiming of land; and the construction of dams. The commission may acquire real estate and riparian rights. Bonds may be issued to finance such purchases. Regulations or ordinances may be prescribed for the government of such public grounds. (Darragh-Fla)
W69-09792

ASPECTS OF STATE STATUTES II,
Minnesota Univ., Minneapolis. Water Resources Research Center.
For primary bibliographic entry see Field 06E.
W69-09798

ZABEL V TABB (PERMIT TO DREDGE AND FILL IN NAVIGABLE WATERS).

296 F Supp 764-771 (MD Fla 1969).

Descriptors: *Florida, *Landfills, *Rivers and Harbors Act, *Navigation, Dredging, Navigable waters, Submerged lands, Ownership of beds, Channels, Bridges, Administrative agencies, Conservation, Bays, Beach erosion, Floods, Wildlife, Ecology, Harbors, Federal government, Permits, Legislation, Culverts, Judicial decisions, Legal aspects, Administrative decisions.
Identifiers: Obstruction to navigation, Intracoastal waterways, Corp of engineers.

The plaintiffs applied for a permit under the Rivers and Harbors Act to dredge and fill in navigable waters. Their application was denied and plaintiffs sought judicial relief. Title to the submerged land rested in the plaintiffs and they obtained consent to do the work from all local agencies concerned. The facts showed that the work would have no detrimental effect on navigation. No effect would be rendered on erosion or flood heights, but the secretary found there would be a detrimental effect to wildlife and denied the petition. The court acknowledged that it could not overturn the decision of an administrative agency unless it was contrary to law as not within the discretion of the agency. The court stated that the act only gave defendants authority to refuse a permit when there would be a detrimental effect to navigation. Defendants contended that they should be able to apply the Fish and Wildlife Coordination Act and deny the permit for reasons other than navigation. The court held that the legislation did not give the defendants the authority to deny a permit for dredge and fill where they had factually determined that the proposed construction would not interfere with navigation. The court decided that it had jurisdiction to grant the plaintiffs relief. (Shevin-Fla)
W69-09802

DUTIES AND POWERS OF STATE HIGHWAY DEPARTMENT.

SC Code Ann secs 33-71, 33-73, 33-81 (1962).

Descriptors: *South Carolina, *Highways, *Bridges, *Drainage, Administrative agencies, Road construction, Canals, Drainage canals, Culverts, Ditches, Embankments, Wharves, State governments, Legislation, Transportation.

The powers and duties of the State Highway Department include building and maintaining public highways and bridges and acquiring land needed for such highways and bridges. The Department may bring suit for injury to any road, bridge, culvert, ditch, causeway, embankment, wharf, or other facility belonging to the state. The Department may cooperate with any drainage district in order to carry drainage canals across state highways. (Helwig-Fla)
W69-09805

DRAINAGE OF LAND ADJACENT PUBLIC ROADS.
Del Code Ann tit 17, secs 901-904 (1953), as amended, (Supp 1966).

Descriptors: *Delaware, *Highways, *Drainage, *Ditches, Conduits, Legislation, Flooding, Standing waters, Riddance (Legal aspects), Right-of-way, Surface runoff, Road construction, Drainage water, Embankments, Paving, Contours, Flow control, Topography.
Identifiers: Natural drainage.

The State Highway Department shall drain by suitable means waters which have backed upon lands along the right-of-way of any road caused by the changing of the natural contour lines whereby the natural drainage is retarded. The Department shall cause suitable ditches or conduits to be constructed along any highway so constructed as to cause water to collect on adjacent land. The Department may enter an agreement with any ditch company to clean drainage ditches along any highway. (Helwig-Fla)
W69-09813

PORTS AND MARITIME MATTERS.

SC Code Ann secs 54-1 thru 54-64 (1962).

Descriptors: *South Carolina, *Port authority, *Regulation, *Administrative agencies, State governments, Federal government, State jurisdiction, Ports, Harbors, Seaports, Watercraft, Transportation, Bridges, Causeways, Water policy, Water planning, Loans, Principal, Interest.
Identifiers: *Penalties (Civil).

The South Carolina State Port Authority is created to promote, develop, construct, and maintain the state harbors and seaports. The Authority has the powers of a corporate body. It may acquire and dispose of real and personal property, acquire, maintain, equip, and operate wharves, docks, shi piers, and other facilities required in commerce, cluding airports, naval and seaplane bases and a other facility necessary to carry out the purposes the Authority. The Authority has general super sion of all wharves, warehouses, and terminal fac ties in Charleston and examines them w reference to the security and accommodation the public and compliance with all applicab provisions of the law. The Authority may fix t lines along the bay and harbor of Charleston a the rivers and creeks flowing therein within wh riparian owners may erect wharves, docks, a other proper erections and fixtures for commerci manufacturing, or any other purposes. T Authority may issue bonds, payable both as to pr cipal and interest from revenue derived from t operation of its properties and facilities. (Moulde Fla)
W69-09816

CITY OF COON RAPIDS V SUBURBAN E GINEERING INC. (FAILURE TO ME SPECIFICATIONS FOR A DRAINA SYSTEM).

167 NW 2d 493-497 (Minn 1969).

Descriptors: *Minnesota, *Storm drains, Sewe Closed conduits, Pipes, Drainage, Local gover ments, Cities, Judicial decisions, Damag Remedies, Legal aspects, Specifications, Mai tenance, Repairing, Drainage systems.

Before defendants could carry out plans to devel and sell land to the public within plaintiff city, was necessary to install an adequate storm sew system. Plaintiff agreed that if defendants would stall a sewer system according to certain specific tions, the city would accept it and bear the expen of future maintenance. The sewer system was stalled and defendants assured plaintiff that t specifications had been fulfilled. There was so question as to whether the plaintiff in accepting t sewer system relied on this representation or on t report of their own engineer who apparently or made a cursory insepction of the system. So time later, after continued repairs, plaint discovered the sewer was not built according specifications and filed a suit for damages. T lower court, being of the opinion that the statute limitations had run and that claims of fraud we merely attempts to disguise the true cause of a tion, granted defendants motion for summa judgment. Plaintiff appealed and the court revers and remanded the case holding that there was su cient evidence of fraud to preclude a summa judgment. (Gabrielson-Fla)
W69-09817

EXTENSION OF BOULEVARD OVER PUBL WATER WAYS.
Ill Ann Stat ch 105, secs 125 thru 129 (Smith-Hu 1952).

Descriptors: *Illinois, *Administrative agenci *Water policy, *Construction, Navigation, Le aspects, Water law, Ownership of beds, Admin tration, Projects, Legislation, Riparian righ Parks, Land use, Navigable waters, Relative righ Riparian land, Water utilization, Beds under wat Roads, Road construction.
Identifiers: Boulevard extension, Public waters.

Every board of park commissioners has author to extend any boulevard or driveway which bord any public waters of the state up to two hundr feet over and upon the bed of such waters provic that commercial navigation is not damag thereby. Consent of at least two-thirds of owners abutting such waters for such project, c sent of the supervisor and assessor corpor authorities of the town wherein the proposed tension lies, and presentation of a plan contain an estimate of the cost of such project prerequisite to construction of such an extensi The board may acquire riparian rights fr

ng land owners. The board has title to such erged lands as are included between the shore ch public waters and the inner line of the ex- on of such boulevard or driveway and may y title to such submerged lands for the pur- of defraying the cost of such extension. Exten- and the beds thereunder owned by the board be maintained and controlled by the board in anner provided by law for the government maintenance of other boulevards and ways. (Johnson-Fla)
09818

GATION AND WATERS (VESSELS).

at Ann tit 25, secs 1-3, 41-45, 81-83 (1959).

riptors: *Vermont, Legislation, *Regulation, reation, *Water sports, Boats, Boating, Use of , Sailing, Natural use, Non-consumptive use, portation, Navigation, Navigable waters, r allocation (Policy), Regulations, Safety, ming, Boating.
ifiers: Little Lake St. Catherine, Lake Cham- Boatable water, Big Lake St. Catherine, Lake seen, Rutland County.

erson shall operate any motorboat or vessel in eless or negligent manner. In the event of resulting from the careless or negligent tion of a boat or vessel, the punishment shall xceed five years or more than two thousand rs or both. Additional restrictive safety regula- concerning mufflers and speed are imposed. tate board of forests and parks is empowered ake rules and regulations concerning the nation of restricted swimming areas in any ble waters located within the state. The er in charge of a vessel not carrying freight or ngers for hire shall show one good and suffi- light in some conspicuous place, near the Vessels on Lake Champlain within Vermont carry and show such lights. (Moulder-Fla)
-09819

ERS AND STREAMS (GENERAL PROVI- NS).

at Ann tit 25, secs 141-146 (1959).

riptors: *Vermont, *Rivers, *Streams, *Ob- tion to flow, Legislation, Regulation, Ease- s, Relocation, Channels, Beds, Channel im- ement, Floodways, Diversion structures, Flood ol, Lakes, Ponds, Prescriptive rights.
ifiers: *Channel restoration, Floodwood, age, Adverse possession.

blic easement in a stream shall not be lost or ged by prescription or adverse possession. channel of a non-navigable river or stream h becomes changed, may be restored by the ns through whose land it formerly flowed. n obstructions change or prevent the even flow ter between the main banks of a stream, the rty owner may apply to the town selectmen uthorization to remove the obstruction at his expense. In the case of negligent deposits of , gravel, debris, floodwood, or rubbish by a n other than the property owner, a petition fying the negligent person may be offered to wn selectmen for action. When a person con- s himself injured by the action of the select- he may apply to the court of chancery for re- All land which may be flowed by damming, g, storing, or diverting the waters of any m, river, lake, or pond by a corporation or as- tion existing under charter or authority of the shall, prior to the flowing, be cleared of trees ushes. (Moulder-Fla)
-09820

IGATION AND WATERS.

at Ann tit 25, secs 201-207, 241-246 (1959).

Descriptors: *Vermont, *Logging, *Lumbering, *Obstruction to flow, Legislation, Regulation, Lumber, Timber, Streams, Banks, Non-consumptive use, Riparian rights, Water utilization, Properties, Damages.
Identifiers: Penalties (Civil).

General provisions cover the anchoring of log booms on land bounding upon the river or stream down which logs are run. Lodged lumber not taken away by the owner before May 1, may be retained by the landowner until he is paid for damages suffered. If the lumber is not removed by November 1, the landowner may take the lumber and convert it to his own use; however, he must first advertise the lumber in the town where the lumber is lodged. When the landowner and lumber owner cannot agree upon damages, the town selectmen shall make a final adjustment. In the case of damage by floating lumber, either party may also prefer a petition to the public service commission, which shall determine the cause of property damage. The county court shall render judgment. Foreign corporations must post bond before floating lumber down the rivers and streams of the state. Penalties for violations of these provisions are provided. (Moulder-Fla)
W69-09821

FLOOD CONTROL.

Ark Stat Ann sec 17-315 (1968).

Descriptors: *Arkansas, *Flood control, *Flood protection, *Eminent domain, Water management (Applied), Control structures, Check structures, Levees, Reservoirs, Easements, Legal aspects, Legislation, Condemnation, United States, Local governments, Construction.

The county governments of the state may enter upon and take lands, or easements on lands, by purchase, grant, donation, devise or eminent domain for the purpose of locating, constructing and managing floodways, reservoirs, spillways, levees, or other flood control improvements. If eminent domain must be exercised to acquire lands or interests therein, the county government shall proceed as provided by statute. Nothing in this act shall be construed to relieve the United States of any responsibility or liability which it has assumed by the federal flood control acts. (Kelly-Fla)
W69-09823

ACQUISITION OF UTILITIES AND RECLAMATION OF PREVIOUSLY SUBMERGED LAND BY CITIES.
Ill Ann Stat ch 24, secs 11-123-1 thru 11-123-7, 11-123-10, 11-123-20, 11-123-21, 11-123-22, 11-123-24 (Smith-Hurd 1960) as amended (Supp 1969).

Descriptors: *Illinois, *Land reclamation, *Ownership of beds, *Utilities, Cities, Waterworks, Public utilities, Legislation, Condemnation, Rivers, Levees, Canals, Docks, Piers, Harbors, Breakwaters, Channels, Right-of-way, Land forming, Accretion (Legal aspects), Water utilization, Beds, Administration, Reclamation.
Identifiers: Public waters, Harbor development, Harbor structures.

The term 'utility' is defined as including harbors, canals, slips, wharves, docks, levees, piers, quay walls, breakwaters, and all appropriate harbor structures. The term 'artificially made or reclaimed land' is defined to include all land which formerly was submerged under the public waters of the state, the title to which is in the state, and which has been artificially made or reclaimed, in whole or in part, contrary to law. Any city may acquire utilities by purchase, condemnation, or otherwise and may operate utilities located within its jurisdiction or in, over, and upon public waters bordering thereon. Specific provisions for reclamation by a city of specified submerged land and artificially made land are made to enable the city to operate utilities. Accretions or artificially made or reclaimed land which are formed or added to any utility constructed under the foregoing authority become the property of the city. A city is empowered to condemn any land or right-of-way for the purpose of widening, deepening, or otherwise improving a river or harbor. (Keith-Fla)
W69-09824

WATER SUPPLY, DRAINAGE FLOOD CONTROL.

Ill Ann Stat ch 34, secs 3115-3123 (Smith-Hurd 1960), as amended, (Supp 1969).

Descriptors: *Illinois, *Water supply, *Sewage, *Flood control, United States, State governments, Local governments, Water pollution, Financing, Waterworks, Maintenance, Planning, Treatment facilities, Pollution abatement, Regulation, Water resources.

The county board may cooperate with federal agencies, municipalities, and political subdivisions of this state for planning, construction and improvement of flood control, water supply and sewage facilities. The board has authority to prevent water pollution and to cause any person, party or corporation to halt activities resulting in pollution. Bonds may be issued for financing and are to be paid off by use of revenues from waterworks or sewage treatment facilities. Rates for use shall be sufficient to provide funds for the maintenance and depreciation of facilities and for the payment of the principal and interest on bonds. Rules and regulations for use are promulgated by ordinance. (Darragh-Fla)
W69-09825

INDIVIDUAL DRAINAGE RIGHTS.
Iowa Code Ann, secs 465.1 to 465.29 (1949), as amended, (Supp 1969).

Descriptors: *Iowa, *Drainage, *Surface drainage, *Subsurface drainage, Legislation, Ditches, Tile drainage, Mine drainage, Obstruction to flow, Damages, Legal aspects, Levees, Railroads, Highways, Controlled drainage, Compensation, Local governments, Natural flow, Discharge (Water), Drains, Boundaries (Property).
Identifiers: Individual drainage rights.

Landowners desiring to construct any levee, open ditch, tile, or underground drain, for agricultural, mining, or improved drainage purposes across the lands of others or the right of way of a railroad or highway may file an application with the township clerk setting forth the description of the land and the specifications for such levee, ditch, or drain. The township trustees shall then conduct a hearing to determine the desirability of such system, the permissible specifications therefor, and the compensation to be paid by the applicants for property damages by reason of the construction. Where such construction is through railroad property, the railroad company may choose to construct such improvement. Any dispute as to the repair of a constructed drain shall be determined by the trustees. Any person obstructing such drain shall be liable to the owner of the drained lands for damages caused thereto. Landowners may drain their land in the general course of natural drainage by constructing or reconstructing, wholly upon their own land, open or covered drains, discharging the same in any natural watercourse or depression, and shall not be liable in damages therefor. (Marsee-Fla)
W69-09826

DRAINAGE AND LEVEE DISTRICTS WITH PUMPING STATIONS.

Iowa Code Ann, secs 461.1 to 461.24 (1949), as amended, (Supp 1969).

Descriptors: *Iowa, *Pumping plants, *Drainage systems, Drainage programs, Surface waters, Drainage engineering, Drainage practices, Chan-

neling, Controlled drainage, Pumps, Watersheds (Basins), Water conveyance, Legislation, Legal aspects, Levees, Regulation, Administrative agencies, Costs, Construction costs, Assessments.

In counties where a drainage district has been established, the Board of County Supervisors may establish and maintain pumping stations if these are necessary for proper drainage of the land comprising the district. The costs of construction and maintenance of a pumping station may be assessed against lands in the district which are thereby benefited. The county board may act to establish a station only upon petition by one-third of the affected landowners. The lands benefited by such a station will be determined by the board and by report of an engineer appointed by the board of supervisors. After the establishment of a drainage district and pumping plan, but before completion of the improvement, the board may resolve to establish such additional pumping stations as the engineer may recommend. The board must consider petitions by landowners for additional pumping stations. The board, upon receipt of the proper petition from the landowners, may act to divide a drainage district in which two or more pumping stations are operating. A county board may acquire lands for a channel running from overflowed lands to a settling basin if flooded conditions exist in its district, and if a basin has been provided. (Kelly-Fla)
W69-09827

IOWA NATURAL RESOURCES COUNCIL.
For primary bibliographic entry see Field 06B.
W69-09828

FEDERAL FLOOD CONTROL COORDINATION.
Iowa Code Ann, secs 455.201 to 455.217 (1949), as amended, (Supp 1969).

Descriptors: *Flood control, *Iowa, *Drainage districts, *Administrative agencies, Coordination, Engineering estimates, Damages, Benefits, Conservation, Local governments, Financing, Legislation, Construction costs, Cost allocation, Appraisals, Assessments, Meanders, Streams, Levees, Federal government.

Whenever the United States government files a plan for improvements to a water district with the county auditor, the board of supervisors of the county has authority, after notice and hearing, to accept said plan and pay that portion of the expenses not paid by the federal government. No notice or hearing is necessary where the plan's cost does not exceed 25% of the total previous district expenditures. After the plan is filed, an engineer is appointed to examine the plan and report to the board. If the report is favorable and the board accepts the plan, then appraisers are appointed to determine damages and commissions are appointed to assess benefits derived. If the district is managed by a board of trustees, they will perform the functions of the board of supervisors. Any levee or drainage district may use, as a permanent easement, lands owned by the state upon permission from the appropriate state agency. (Darragh-Fla)
W69-09829

BRIDGES OVER NAVIGABLE RIVERS.
Ill Ann Stat ch 121, secs 192, 193a (Smith-Hurd 1960).

Descriptors: *Illinois, *Navigable rivers, *Bridges, *Bridge construction, Piers, Legislation, Abutments, State governments, Federal government, Political aspects, Administration, Interstate, Regulation, Boundaries (Property), Rivers, Navigation, Construction, Channels, Reinforcement, Interstate rivers, Mississippi River, Ohio River, Structures.
Identifiers: Illinois River, Congress, Pier protection.

The state assents to the construction of bridges across navigable rivers in the state and upon its boundaries whenever the Congress of the United States so authorizes. If any state bordering the Ohio or Mississippi Rivers refuses to grant these privileges for the construction of a bridge over the above mentioned rivers into that state, Illinois will not allow any bridge company from the other state to build a bridge into Illinois. Every person owning or managing a bridge over a navigable portion of the Illinois River shall construct, contiguous to the channel of the river, adequate pier protection for the piers of such bridge. Such construction must be adequate to meet navigation requirements existing at the time and expected during the future life of such piers. (Shevin-Fla)
W69-09830

MISSISSIPPI BRIDGES PURCHASED.

Iowa Code Ann sec 313.66 (Supp 1969).

Descriptors: *Iowa, *Bridges, *Mississippi River, Maintenance, Cities, Highways, Administrative agencies, Local governments, Legislation, Interstate, Interstate rivers.

The Highway Commission may purchase and maintain one half of any bridge over the Mississippi River which is in receivership and which connects a primary road in a city of the state to a corresponding road in an adjoining state. Payment not to exceed $100,000 will be paid from the primary road fund only after the purchase has been approved by the proper board of supervisors, city council and school board or boards and the adjoining state has agreed to purchase the other half of the bridge. (Darragh-Fla)
W69-09834

DRAINAGE.
Ill Ann Stat ch 42, secs 2-1 thru 2-11 (Smith-Hurd 1956), as amended, (Supp 1969).

Descriptors: *Illinois, *Drains, *Drainage practices, *Surface drainage, Easements, Controlled drainage, Damages, Ditches, Structures, Levees, Construction, Maintenance, Legal aspects, Beneficial use, Legislation, Natural flow, Benefits.
Identifiers: Upland owners, Lowland owners.

Land may be drained in the general course of natural drainage by either open or covered drains. When such a drain is entirely on the land of the owner constructing the drain he is not liable for damages arising from such construction. A covered drain may be extended through the land of others under specified circumstances through the use of specified judicial procedure. The owner of a drain which is extended through the land of others may enter such land to maintain his drain, but is liable for damage he causes. The term 'drains and levees for mutual benefit' is defined and the mutual beneficiaries are given a perpetual easement on all lands concerned. The consent of all existing beneficiaries is required for legal connection to mutually beneficial drains and levees. (Keith-Fla)
W69-09835

WATER NAVIGATION REGULATIONS.

Iowa Code Ann secs 106.12-106.17 (Supp 1969).

Descriptors: *Iowa, *Boating regulations, *Administrative agencies, *Navigation, Legislation, Legal aspects, Boats, Navigable waters, Water skiing, Surf-boarding, Jurisdiction, Federal government, Local governments, State governments, Recreation.
Identifiers: Penalties (Criminal).

No person shall operate any vessel, or manipulate any water skis, surfboard or similar device in a careless, reckless, or negligent manner, nor operate such devices while intoxicated or under the influence of any narcotic, barbituate, or marijuana. Cans, bottles, and other rubbish shall not discarded in any public waters. No blue or flashi blue light may be used except on authorized em gency vessels. No vessel having over 6 horsepow shall be operated by a person under 12 years of a unless accompanied by a responsible person years of age or over. Fines and imprisonment a established for any person convicted of operatin vessel while intoxicated or under the influence drugs. Regulations are established for the use water skis and surfboards. The commission m authorize the holding of regattas, motorboat other boat races, marine parades, tournaments exhibitions on any waters of this state under the risdiction of the commission. The provisions of t section shall not exempt any person from co pliance with applicable federal law or regulatio When any local regulations conflict with any pro sion of this chapter, the local law will be inope tive. (Heckerling-Fla)
W69-09839

BENEFITED WATER DISTRICTS.

Iowa Code Ann secs 357.1-357.33 (1949), amended, (Supp 1969), sec 357.34 (Supp 1969)

Descriptors: *Water districts, *Local governmer *Benefits, *Iowa, Legislation, City planning, A sessments, Planning, Contract, Construction, Co pensation, Condemnation.

The board of supervisors of any county, upon pe tion for construction of a water district brought twenty five percent of the property holders in su proposed water district, may grant a hearing determine the advisability of such constructi The district may include all or part of any inc porated city with or without surrounding territo An engineer will be appointed to design the distri After approval of the plan by popular vote, bids be taken for construction of the district. The p ject will be paid for by assessments based u benefits derived. The district trustees are powered to contract to purchase water for the trict if the source of water is without the distric the source is within the district, they may drill water and reservoir it. Additional subdistricts private mains may be constructed. The board of pervisors may condemn needed property. (D ragh-Fla)
W69-09843

VAN DUYSE V FLEMING (NATUR DRAINAGE OVER ADJACENT LAND).
432 SW 2d 10-11 (Ark 1968).

Descriptors: *Arkansas, *Surface drainage, *T drainage, *Drainage effects, Dams, Levi Ditches, Judicial decisions, Natural flow doctri Obstruction to flow, Relative rights, Land tent Floods, Silts, Silting, Damages.
Identifiers: *Injunction, Natural drainage.

Appellant and appellee are adjacent landown Appellee maintains a dam on his property, wa from which drains onto appellant's land. In a pr suit appellant sought damages and an injunctio abate the maintenance of the pond. The trial co found that there was a natural drainage crossing appellant's land. The court ordered app lant to remove a levee he had constructed to struct the natural drainage. The trial court later dered appellant to construct a drainage ditch ar larger drain tile through the levee. In the pres action appellant sought another injunction damages caused by alleged silting. The chance denied appellant's requests and ordered him comply with the previous court order. T Supreme Court of Arkansas upheld the chan lor's decree on all points. (Harris-Fla)
W69-09851

SOLOMON V CONGLETON (RIGHT TO STRUCT NATURAL WATERCOURSES A

SURFACE DRAINAGE).

232 SW 2d 865-868 (Ark 1968).

Descriptors: *Arkansas, *Obstruction to flow, Natural streams, *Surface drainage, Beds, Banks, Land tenure, Natural flow doctrine, Relative rights, Judicial decisions, Levees, Floods, Surface water, Water discharge, Flow, Swamps, Bogs, Shallow water, Watercourses (Legal).
Identifiers: *Sloughs, Lower landowners, Injunction (Mandatory).

Defendant constructed levees which obstructed the flow of water through a slough emptying into a river. Plaintiff sought a mandatory injunction to require their removal. Since it is unlawful to obstruct a natural watercourse, but lawful for a lower landowner to fend off surface water, the question for the chancellor was whether the slough was a natural watercourse. The chancellor issued the mandatory injunction and the defendant appealed. The Supreme Court of Arkansas in affirming, held that plaintiff had a right to the continued unimpeded flow of any natural watercourse crossing his land. Therefore, defendant must maintain channels sufficient to accommodate such waters in ordinary conditions and reasonably expected flood conditions. The court defined a watercourse to be a stream flowing usually in a particular direction, though not necessarily continually. It must have beds and banks and generally discharge into some other body of water. It is thus something more than mere surface drainage. The chancellor's finding that the slough was a natural watercourse was from disputed facts and the supreme court was unwilling to disturb that finding. (Harris-Fla)
W69-09852

SACHS V CHIAT (DAMAGE FROM SURFACE WATER RUNOFF).

162 NW 2d 243-247 (Minn 1968).

Descriptors: *Minnesota, *Reasonable use, *Alteration of flow, *Surface runoff, Riddance (Legal aspects), Drainage, Water, Repulsion (Legal aspects), Surface waters, Land tenure, Surface drainage, Overland flow, Precipitation excess, Storm runoff, Land use, Legal aspects, Judicial decisions, Natural flow doctrine, Relative rights, Piles (Foundations), Pile driving, Damages, Civil law, Land use.
Identifiers: Injunctions (Prohibitory), Upper landowners, Lower landowners.

Plaintiff and defendant were adjacent land owners in a residential area. The concussion from pile driving during the construction of defendant's residence damaged plaintiff's residence. Surface water draining from defendant's higher land caused injury to plaintiff's land. Plaintiff sought recovery for damages and an injunction to prevent the continuance of drainage. From a verdict for defendant and denial of the injunction, plaintiff appealed. The court reversed on the issue of damages, holding that pile driving was an ultra-hazardous activity and that negligence did not have to be shown for liability to arise. However, a land owner is only liable for damage caused by the flow of surface water from his land if the natural flow is altered by an unreasonable use of the land. A jury could properly find defendant's use of his land reasonable under the circumstances. The injunction was properly denied because defendant had taken measures to avert the harmful flow except under abnormal conditions. (Helwig-Fla)
W69-09857

HAMPTON HARBOR AND BEACH EROSION CONTROL.

NH Rev Stat Ann secs 216-B:1 thru 216-B:6 (1964).

Descriptors: *New Hampshire, *Channel improvement, *Erosion control, *Harbors, Beaches, Erosion, Federal government, Legislation, Costs, Government finance, Shores, State governments, Construction, Construction costs, Contract administration, Administrative agencies, Navigation, Navigable waters, Beach erosion, Projects, United States, Legal aspect, Management.
Identifiers: Army Corps of Engineers, Federal-state cooperation, Federal projects.

The governor, with the advice of the council and upon a finding that federal funds will be available, is empowered to undertake in cooperation with the Army Corps of Engineers a project to improve navigation in Hampton Harbor and a project to restore damaged beach areas resulting from erosion on Hampton Beach. The governor and council are authorized to enter agreements with the federal government to secure federal funds, including an assurance that the state will hold the United States free from all damages arising out of said project. It is anticipated that the Corps of Engineers will supervise the project with such state supervision as necessary resting in the commissioner of public works and highways. Upon completion of the projects, the federal government shall assume maintenance of the harbor entrance channel and facilities. The management of the harbor improvement project shall be supervised by the New Hampshire Port Authority and the supervision of the beach project shall be by the division of parks. Construction contracts shall be administered by the commission of public works and highways. The commission shall cooperate with the Corps of Engineers in studies and construction, and shall provide the governor and council with information to implement this act. (Kahle-Fla)
W69-09864

WATERWAYS, DRAINAGE, FLOOD CONTROL, WATER POLLUTION AND WATER RESOURCES STUDY COMM'N.

Ill Ann Stat ch 19, secs 145.31-145.34 (Smith-Hurd Supp 1969).

Descriptors: *Illinois, *Drainage programs, *Flood control, *Water pollution control, Water resources, Administrative agencies, Feasibility studies, Legislation, State governments, Local governments, Cost analysis, Inter-agency cooperation, Planning, Administrative costs, Programs, Administration, Financing.

A nine member Waterways, Drainage, Flood Control, Water Pollution and Water Resources Study Commission is created consisting of members from the state Senate, state House of Representatives, and appointees of the governor. The members shall receive no compensation other than actual expenses. The commission shall study: state and municipal problems of waterways, drainage, flood control, water pollution and water resources; the feasibility of plans to promote interagency cooperation in regard to such matters; the costs of administering programs and the sources of revenue for such matters; the feasibility of state programs or grants-in-aid to local governments for such programs; and the need for revision of laws concerning such problems. The commission may request and receive any necessary data and reasonable assistance from state or local officials. The commission may receive gifts or grants from any federal, state, or private agency for the purpose of carrying out its duties. The commission shall report its findings and make recommendations for legislation it deems necessary each odd numbered year. (Kahle-Fla)
W69-09874

4B. Groundwater Management

CLOGGING IN SURFACE SPREADING OPERATIONS FOR ARTIFICIAL GROUNDWATER RECHARGE,
Agricultural Research Service, Fresno, Calif. Groundwater Recharge Field Station.
Jerold J. Behnke.
Water Resources Res, Vol 5, No 4, p 870-876, Aug 1969. 7 p, 5 fig, 2 tab, 11 ref.

Descriptors: *Water spreading, *Filtration, *Artificial recharge, *Permeability, Turbidity, Porous media, Particle size, Porosity, Suspended load.
Identifiers: Filter clogging.

Clogging is a complex phenomenon dependent upon many variables. For the conditions studied it is essentially a surface-sealing process. When turbid water contains a range of grain sizes, clogging is initiated by the deposition of a surface layer that is graded because of the gravitational segregation of heavier particles. Most of the clogging results from the straining of finer particles from the flowing water by the graded depositional layer. An equation was developed which predicts accumulated water quantity versus time relationships for several concentrations of a specific turbidity. Even coarse-grained porous media clogged at turbid water concentrations as low as 50 ppm. (Knapp-USGS)
W69-09468

TRANSIENT PRESSURE TESTING OF FRACTURED WATER INJECTION WELLS,
Pan American Petroleum Corp., Tulsa, Okla.
For primary bibliographic entry see Field 02F.
W69-09499

STEADY-STATE FLOW CAPACITY OF WELLS WITH LIMITED ENTRY TO FLOW,
Mobil Research and Development Corp., Dallas, Tex.
For primary bibliographic entry see Field 02F.
W69-09501

KOCIAN V DEVITO (IMPLIED WARRANTY IN DIGGING WELL).
For primary bibliographic entry see Field 06E.
W69-09613

AQUIFER BEHAVIOR WITH INJECTION,
Petrobras Co., and Texas A and M Univ., College Station.
E. J. Bonet, and Paul B. Crawford.
J Petrol Technol, p 1210-1216, Sept 1969. 7 p, 6 fig, 13 ref, append.

Descriptors: *Injection wells, *Mathematical studies, Groundwater movement, Flow, Flow rates, Aquifers, Oil reservoirs, Recharge, Secondary recovery (Oil).
Identifiers: Linear closed aquifer analysis.

Water injection flow was analyzed mathematically and the results are presented in terms of dimensionless variables. In injection into linear closed aquifers the total flow across a section depends only on proximity to the injection well and has no relation to the well's distance from aquifer boundaries. (Knapp-USGS)
W69-09650

HUMBOLDT RIVER STUDIES,
Nevada Univ., Reno. Desert Research Inst.
W. R. Larson, R. D. Winnergren, E. P. Zeizel, P. A. Domenico, and C. Case.
Nevada Center for Water Resources Research Project Report No 10, Jul 1968. 104 p, 13 fig, 9 tab, 38 ref, 7 append. OWRR Project A-010-NEV.

Descriptors: *River Basin development, *Surficial geology, Irrigation, Sediments, Wells (High yield), Recharge (Artificial), *Statistical technique, High flow.
Identifiers: *Humboldt River Basin.

The maximum beneficial use of the total water supply for irrigation in Humboldt River Basin requires that both surface water and groundwater be used. Successful integration of these supplies entails hydrogeologic, legal and economic considerations. In that the Humboldt River Basin sediments

are highly transmissive and, therefore, capable of producing high yield wells, the hydrogeologic problem was reduced to ascertaining the potential for recharge. This problem is analyzed by applying statistical techniques to high flows and to the relationship between recharge and surficial geology, and by field mapping. The legal problem centers around acquisition of rights to pump, anticipated interference with surface water rights, priorities, possibility of artificial recharge, and forfeiture due to nonuse during periods of sufficient water. The economic problem is complicated in that groundwater is to be used to supplement a stochastic surface water supply with a deterministic demand. Further, the nonconcurrence of the areas of major water use and the most productive aquifers involves costs that may preclude use of groundwater altogether. The economic problem is analyzed in terms of current net benefits of surface water and influence of supplemental pumping on these benefits. (Johnson-Univ of Nev)
W69-09724

4C. Effects on Water of Man's Non-Water Activities

FOLEY V STATE (DAMAGES FOR ELIMINATION OF WATER SUPPLY).
For primary bibliographic entry see Field 06E.
W69-09610

MOREY V STATE (LIABILITY FOR HIGHWAY CHANGE OF GRADE).
For primary bibliographic entry see Field 06E.
W69-09611

FEDERAL WATER RESOURCES PROJECTS.
For primary bibliographic entry see Field 06E.
W69-09640

HYDROGEOLOGICAL EQUATIONS FOR DETERMINING GROUNDWATER YIELDS IN THE DRAINAGE OF OPENCAST MINES AND LARGE BUILDING PITS (GERMAN),
For primary bibliographic entry see Field 02F.
W69-09648

SEDIMENT MOVEMENT IN AN AREA OF SUBURBAN HIGHWAY CONSTRUCTION, SCOTT RUN BASIN, FAIRFAX COUNTY, VIRGINIA, 1961-64,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02J.
W69-09683

BALTIMORE'S WATERSHEDS: AN EXAMPLE OF INTEGRATED LAND USE,
Forest Service (USDA), Washington, D.C. Div. of Watershed, Recreation, and Range Research; and Bureau of Water Supply, Baltimore, Md.
Irvin C. Reigner, and Louis G. Ningard.
Journal American Water Works Association, Vol 59, No 11, p 1469-1477, illus, 1967.

Descriptors: *Watershed management, *Water supply, *Forest management, *Recreation, Aesthetics, Fishing, Land use, Public health, Recreation demand, Recreation wastes, Reservoirs, Sediment control, Water yield improvement, Multiple-purpose projects, Maryland.
Identifiers: *Logging (Forest), *Experimental watersheds.

Municipal watersheds are being subjected to increasing pressure for other uses. This paper presents a brief description and history of forest management on the 17,300-acre watershed owned by the city of Baltimore, Maryland. Water quality protection, timber production, and recreation are the three principal functions of the area. A knowledge of how these uses are successfully accommodated on one watershed should help managers in other areas.
W69-09761

PLAN AND PROGRAM FOR THE BRANDYWINE,
Pennsylvania Univ., Philadelphia. Inst. for Environmental Studies.
For primary bibliographic entry see Field 06B.
W69-09768

CHANGES IN ROADS, STREAMS, OR DRY RUNS.

Iowa Code Ann sec 306.21 (Supp 1969).

Descriptors: *Iowa, *Highway relocation, *Bodies of water, *Diversion, Alteration of flow, Road construction, Legislation, Administrative agencies, Bridge construction, Streams, Dry beds, Safety, Erosion control.

Boards of supervisors on their own motion may change the course of any secondary road, stream, or dry run in any county to avoid the construction and maintenance of bridges, grades, or railroad crossings, or to cut off dangerous turns and prevent encroachment of streams on the highways. (Harris-Fla)
W69-09837

4D. Watershed Protection

RESTORATION OF GULLIED VALLEY FLOORS IN ARID AND SEMIARID REGIONS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02J.
W69-09506

RELATION OF SOIL PROPERTIES TO ITS ERODIBILITY,
Agricultural Research Service, Lafayette, Ind.; and Purdue Univ., Lafayette, nd.
W. H. Wischmeier, and J. V. Mannering.
Soil Sci Soc Amer Proc, Vol 33, No 1, pp 131-137, Jan-Feb 1969. 7 p, 1 fig, 4 tab, 17 ref.

Descriptors: *Soil properties, *Erosion, Erosion control, Slopes, Soil density, Infiltration, Rainfall-runoff relationships, Rainfall, pH, Soil chemical properties, Runoff, Soils, Soil science, Soil tests, Land use, Subsoil, Soil texture, Organic matter, *Agriculture, Bibliographies.
Identifiers: *Erosion index, Infiltration capacity.

The inherent erodibility of soil, a major factor in erosion prediction and land-use planning, is a complex property dependent on infiltration capacity and capacity to resist detachment and transport by rainfall and runoff. The relations of these capacities to soil physical and chemical properties were investigated in a 5-yr field, laboratory, and statistical study including 55 selected Corn Belt soils. Properties that contributed significantly to soil-loss variance included percentages of sand, silt, clay, and organic matter; pH, structure, and bulk density of plow layer and subsoil; steepness and concavity or convexity of slope; pore space filled by air; residual effects of sod crops; aggregation; parent material; and various interactions of these variables. An empirical equation was derived for calculating the erodibility factor K of the universal soil-loss equation for specific soils. Tests of the equation against soils of the older erosion-research stations, for which the erodibility factor is known, substantiated general applicability over a broad range of medium-textured soils. (USBR)
W69-09534

A NEW EXAMINATION OF SEDIMENT SUSPENSION IN OPEN CHANNELS,
Agricult ural Research Service, Oxford, Miss.
Neil L. Coleman.
J HYDRAUL Res, Vol 7, No 1, p 67-82, 1969. 16 p, 8 fig, 1 tab, 10 ref, append.

Descriptors: Open channel flow, *Sediment
centration, *Sediment distribution, Sediment
*Suspended sediments, Turbulence, Rivers,
nel s, Flumes, Hydraulic models, Boundary
Channel flow, Fluid flow, River flow, Strea
Reynolds number, *Sediment transport, Hy
lics, Hydrology.
Identifiers: Channel beds.

The concentration of suspended sediment ne
bed of a channel is inversely proportional t
distance from the channel boundary. Further
the boundary in the open stream, the concentr
varies exponentially. This effect suggests that
channel flows with suspended sediment can
vided into an inner suspension region near th
and an outer suspension region in the free st
with different sediment transfer processes in
zones. Analyses were made of sediment conce
tion profiles from river measurements and la
tory flume experiments. Equations were derive
relative sediment concentration in both zones
thickness of the inner suspension zone corre
with the displacement boundary thickness
ratio of sediment boundary layer thickness to
flow depth correlates with Reynolds numbe
not with the ratio of shear velocity to
velocity. The sediment transfer ratio varies lin
with elevation above channel bottom in the
suspension zone and is constant in the outer
(USBR)
W69-09535

SUCCESSFUL SAND CONTROL DESIGN HIGH RATE OIL AND WATER WELLS,
Signal Oil and Gas Co., Los Angeles, Calif.
For primary bibliographic entry see Field 02J.
W69-09649

SOIL EROSION CONTROL PRACTICES PERSPECTIVE,
Harza Engineering Co., Chicago, Ill.
For primary bibliographic entry see Field 02J.
W69-09660

SOIL EROSION AND CONSERVATION NORTHERN JORDAN,
Durham Univ. (England). Dept. of Geography
P. Beaumont, and K. Atkinson.
J Soil and Water Conserv, Vol 24, No 4, p 144
Aug 1969. 4 p, 4 fig.

Descriptors: *Soil erosion, *Erosion control,
cial aspects, Farm management, Land ma
ment, Soil conservation, Governments, Veget
establishment, Water control, Cover crops.
Identifiers: *Jordan.

The way of life of the people in northern Jo
promotes continued misuse of the land and hi
the adoption of erosion control programs. In
completed thus far, attention has been almos
clusively concentrated on improving areas of
owned by the government. Relatively little
sideration has been given to the improveme
agricultural practices which are, in the final a
sis, the root cause of the erosion problem.
government's role in new programs should be
fined to financing large capital projects, for e
ple, dam construction, and intensifying res
concerning the relative productivity of diff
agricultural patterns and crops. Villages shoul
plement conservation at the local level under
own initiative. This will be difficult to instigat
traditionally rural society. (Knapp-USGS)
W69-09663

HYDROLOGIC RESEARCH FOR WATERS ENGINEERING,
Agricultural Research Service, Beltsville,
Hydrograph Lab.
H. N. Holtan.
J Hydrol, Vol 8, No 2, p 207-216, June 1969.
4 ref.

Descriptors: *Water resources development, *Water management (Applied), Planning, Rainfall-runoff relationships, Stochastic processes, Markov processes, Probability, Systems analysis, Meteorology, Hydrogeology, Hydraulics, Reviews, International hydrological decade.
Identifiers: Watershed engineering.

Watershed engineering is dynamically increasing its scope and vitality in order to integrate a complexity of interests in land and water resources. Agriculture, industry and urban interests vie for the choicest land areas, often with contrasting objectives that can be made compatible only through basin planning. Hopefully, the current effort of the International Hydrologic Decade will supply concepts and information helpful to the hydrologic phases of watershed engineering. This article is written to inspire objective thinking in the selection of watersheds for research and in the design of the research model. Both stochastic and deterministic approaches are needed but they require different types of research watersheds, and, most definitely, they require different research models. (Knapp-USGS)
W69-09669

GROUNDWATER RESOURCES OF THE BURIED MAHOMET BEDROCK VALLEY,
Illinois State Water Survey, Urbana. Water Supply Div.
For primary bibliographic entry see Field 02F.
W69-09738

IMPORTANCE OF THE BOIS BRULE RIVER TO RECENT SEDIMENTATION HISTORY OF WESTERN LAKE SUPERIOR,
Wisconsin State Univ., Superior.
For primary bibliographic entry see Field 02J.
W69-09773

SOIL CONSERVATION.

Iowa Code Ann secs 467A.1 to 467A.41 (Supp 1969).

Descriptors: *Iowa, *Soil conservation, *Erosion control, *Administrative agencies, Soil erosion, Legislation, Watershed management, Flood control, Soil management, Sediment control, Conservation, Preservation, State governments, Adjudication procedure, Legal aspects, Assessments, Taxes, Operating costs.

It is declared to be the policy of the Iowa legislature to provide: (1) for the restoration and conservation of the soil and soil resources of the state; (2) for the control and prevention of soil erosion; and (3) for the prevention of erosion, floodwater, and sediment damages. Such provisions shall serve to preserve natural resources, control floods, prevent impairment of dams and reservoirs, assist and maintain the navigability of rivers and harbors, preserve wildlife, protect the tax base, protect public lands, and promote the health, safety and public welfare. The state soil conservation committee is established, and its powers and duties are enumerated. Provisions for the creation of soil conservation districts and district commissioner offices are set forth as are the powers of the districts and commissioners. Subdistricts for the purpose of carrying out watershed protection and flood control programs are authorized and procedure for their formation outlined. Powers of the subdistricts include the power to levy a special annual tax and to tax for watershed protection and flood prevention, to condemn land and interests, and to make assessments for improvements. (Marsee-Fla)
W69-09838

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

PESTICIDES IN SELECTED WESTERN STREAMS-A PROGRESS REPORT,
Geological Survey, Austin, Tex.
Douglas B. Manigold, and Jean A. Schulze.
Pesticides Monit J, Vol 3, No 2, p 124-135, Sept 1969. 12 p, 1 fig, 3 tab, 8 ref.

Descriptors: *Pesticide residues, *Surface waters, *Sampling, *Surveys, *Data collections, Monitoring, Chemical analysis, Gas chromatography.
Identifiers: Pesticide monitoring.

Data are presented from the U.S. Geological Survey program for monitoring pesticides in the streams of the Western United States in the period October 1966-September 1968. The original network of 11 monthly sampling stations, established in October 1965, was increased to 20 in October 1967. Compounds determined include the common chlorinated insecticides and herbicides. All of these pesticides were detected at one time or another; DDT was the most frequently occurring insecticide, and 2,4-D the most common herbicide. The amounts observed were small; the maximum concentrations of DDT and 2,4-D were 0.12 and 0.35 microgram/liter, respectively. Concentrations were highest in the water samples that contained appreciable amounts of suspended sediment. Data obtained thus far in the operation of the network have been insufficient to show real correlation with discharge or season of the year. (Knapp-USGS)
W69-09447

EFFECT OF LIGHT INTENSITY ON PHOTOSYNTHESIS BY THERMAL ALGAE ADAPTED TO NATURAL AND REDUCED SUNLIGHT,
Indiana Univ., Indianapolis. Dept. of Microbiology.
For primary bibliographic entry see Field 02K.
W69-09676

THE ANNUAL AND DIURNAL VARIATION IN THE VERTICAL DISTRIBUTION OF ACID-SOLUBLE FERROUS AND TOTAL IRON IN A SMALL DIMICTIC LAKE,
Atomic Energy of Canada Ltd., Chalk River (Ontario). Biology and Health Physics Div.
J. W. McMahon.
Limnol and Oceanogr, Vol 14, No 3, p 357-367, May 1969. 11 p, 8 fig, 24 ref.

Descriptors: *Lakes, *Stratification, *Iron, *Iron compounds, *Diurnal distribution, Acidic water, Photoactivation, Metabolism, Microorganisms, Analytical techniques, Seasonal, Dissolved oxygen, Spectrophotometry, Sampling, Biological properties, Water temperature, Water circulation, Iced lakes.
Identifiers: Dimictic Lakes, Ferrous ion concentrations.

Variation in the vertical distribution of dissolved iron in Upper Bass Lake, Ontario from March 1966 to February 1967 was measured photometrically using the ferrous specific reagent bathophenanthroline. Acid-soluble ferrous iron was presented throughout all strata with the concentration flucuating in a definite annual pattern. Values of ferrous ion change hourly and follow a diurnal pattern. The concentration of ferrous ion in lake water may be controlled by photochemical reactions and, perhaps, also by metabolic activity of microorganisms. (Gabriel-USGS)
W69-09677

USE OF ENDOCOMMENSAL MOLLUSCAN CILIATED PROTOZOA AS INDICATORS OF WATER QUALITY AND POLLUTION IN ILLINOIS WATERS,
Illinois Univ., Urbana. Water Resources Center.
Eugene B. Small, and Gregory A. Antipa.
Research Report No 24, Water Resources Center, University of Illinois, July 1969. 27 p, 9 fig, 1 table, 31 ref. OWRR Project A-015-Ill.

Descriptors: *Indicators, *Protozoa, Infection, *Mollusks, Water pollution effects, Water quality.
Identifiers: Endocommensal molluscan ciliated protozoa.

Fifteen species of unionid bivalves from seventeen localities in Central Illinois were carefully examined for ciliate protozoan infections. Many ciliates appeared occasionally, but the thigmotrich ciliates Conchophthirus and Heterocinetopsis unionidarum appeared abundantly and consistently. Although Conchophthirus and Heterocinetopsis were the only thigmotrichs uncovered in this study, the isolation of Heterocinetopsis suggests that other thigotrich ciliates may also be found in Illinois. The ciliates Conchophthirus and Heterocinetopsis were tested for their ability to react as very delicate indicators of water quality by planting infected bivalves in areas of known pollution. At intervals after planting, individuals were recovered and carefully examined for the relative abundance of Conchophthirus and Heterocinetopsis. The preliminary results suggest that Heterocinetopsis may be the most critical indicator of biological pollution currently available for Illinois waters. (Betchart-Univ of Ill)
W69-09718

BIOASSAYS FOR MICROCHEMICAL ENVIRONMENTAL CONTAMINANTS,
Foundation of Environmental Biology, Berkeley, Calif.
Richard E. Warner.
Bulletin World Health Organization, Vol 36, p 181-207, 1967. 6 fig, 221 ref.

Descriptors: *Bioassay, *Water pollution sources, Water quality, Water pollution effects, Bibliographies, Bioindicators, Lethal limits, Toxicity, Behavior, Physiological ecology, Environmental effects, Biochemistry, Growth rates.
Identifiers: *Microchemical contaminants, *Environmental contaminants, Histochemical effects, Embryological effects, Regeneration effects, Sensory physiology.

Bioassay procedures, as adapted to the study of actual and potential contaminants of the environment, are reviewed in considerable detail. The methods are grouped according to the nature of the response of the indicator organisms. The following groupings are used: (1) acute response (usually death), (2) behavioural change, (3) physiological change, (4) biochemical and histochemical change, (5) ecological change, (6) embryological and regenerational change, (7) growth change, (8) histological change, and (9) changes perceived by humans or aquatic organisms. Consideration is given to the selection of appropriate tests, the problem of sequential concentration, and the establishment of response syndromes. It is concluded that the essential step of standardizing bioassay techniques must be taken if significant progress is to be made. (Uttormark-Wis)
W69-09749

CHEMICAL WATER QUALITY SURVEY OF THE SURFACE WATERS OF THE BOIS BRULE RIVER AND ITS WATERSHED, WISCONSIN, TRIBUTARY TO LAKE SUPERIOR,
Wisconsin State Univ., Superior.
Donald A. Bahnick, Joseph W. Horton, and R. K. Roubal.
Univ of Wisconsin, Water Resources Center, Report, 1969. 20 p. OWRR Proj A-023-Wis.

Descriptors: *Water quality, *Surface waters, *Wisconsin, Chemical oxygen demand, Dissolved oxygen, River basins, Hydrogen ion concentration, Suspended load, Color, Electrical conductance.
Identifiers: *Bois Brule River (Wis), Northwestern Wisconsin.

A study of certain chemical parameters for the Bois Brule River, Wisconsin Watershed is presented. This study was undertaken in order to establish 'wild river' conditions for streams in the northwestern Wisconsin area. Measurements of nitrogen, phosphorus, copper, dissolved oxygen, chemical oxygen demand, electrical conductivity, pH, total solids, and water color were made during a two month period (1968) at 52 stations along the river and its tributaries. The results of this study are correlated with station locations and rainfall whenever possible. (Bahnick-Wis State Univ)
W69-09770

5B. Sources of Pollution

PESTICIDES IN SELECTED WESTERN STREAMS-A PROGRESS REPORT,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 05A.
W69-09447

POLLUTION AND EUTROPHICATION PROBLEMS OF GREAT SOUTH BAY, LONG ISLAND, NEW YORK,
New York State Dept. of Conservation, Ronkonkoma.
For primary bibliographic entry see Field 05C.
W69-09453

PHOTOSYNTHETIC OXYGEN PRODUCTION IN A POLLUTED TROPICAL ESTUARY,
Asian Inst. of Tech., Bangkok (Thailand). Dept. of Environmental Engineering.
For primary bibliographic entry see Field 05C.
W69-09455

CONCEPTS OF FECAL STREPTOCOCCI IN STREAM POLLUTION,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Cincinnati Water Research Lab.
Edwin E. Geldreich, and Bernard A. Kenner.
J Water Pollut Contr Federation, Vol 41, No 8, Part 2, p R336-R352, Aug 1969. 17 p, 3 fig, 6 tab, 37 ref, 1 append.

Descriptors: *Streptococcus, *Coliforms, *Bioindicators, *Water pollution sources, Aquatic bacteria, Runoff, Storm runoff, Water pollution, Surveys, Sampling, Water pollution effects.
Identifiers: *Fecal streptococci, Bacterial survival times.

Results of an intensive study on the occurrence and strain distribution for 12,536 fecal streptococcus strains found in warm-blooded animal feces and numerous water sources from a wide geographical area reveal several new factors that must be understood for a proper interpretation of the sanitary significance of this bacterial group in water pollution studies. The ubiquity of Streptococcus faecalis var. liquifaciens in the water environment and the occasional occurrence of an atypical S. faecalis associated with vegetation shows the need for including the fecal coliform examination in recreational water quality measurements. Applications of the fecal streptococcus indicator system in stream pollution are the development of fecal coliform to fecal streptoccus ratios that will further define possible sources of the fecal discharge into the stream; and the detection of the S. bovis and S. equinus subgroup which was not found in human feces and may be considered a specific indicator of non-human animal pollution. (Knapp-USGS)
W69-09456

EFFECT OF ENVIRONMENTAL FACTORS ON BENTHAL OXYGEN UPTAKE,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering and Dow Chemical Co., Midland, Mich. Waste Treatment Div.
For primary bibliographic entry see Field 05C.
W69-09457

EFFECT OF SLUDGE DEPTH ON OXYGEN UPTAKE OF A BENTHAL SYSTEM,
Perkins (Dana F.) and Sons, Inc., Reading, Mass.; and Tufts Univ., Medford, Mass.
For primary bibliographic entry see Field 05C.
W69-09474

LINDANE DIFFUSION IN SOILS:[1]. THEORETICAL CONSIDERATIONS AND MECHANISM OF MOVEMENT,
California Univ., Riverside. Dept. of Soils and Plant Nutrition; and Agricultural Research Service, Riverside, Calif.
Wilfried Ehlers, J. Letey, W. F. Spencer, and W. J. Farmer.
Soil Sci Soc Amer Proc, Vol 33, No 4, p 501-504, July-Aug 1969. 4 p, 4 fig, 10 ref.

Descriptors: *Diffusion, *Insecticides, *Soils, *Pesticide kinetics, Soil water movement, Path of pollutants, Mass transfer, Thermodynamic behavior, Chlorinated hydrocarbon pesticides, Saturated flow, Unsaturated flow.
Identifiers: *Lindane.

Equations are developed to describe the combined vapor and 'nonvapor' phase diffusion of a volatile insecticide in soils and compared with the diffusion of lindane in a Gila silt loam in a transient state system. The quantity of diffused lindane appears to increase linearly with increased lindane concentration in the treated soil up to about 20 ppm but deviates from linearity at higher concentrations. The diffusion coefficient of lindane is independent of time until 22 ppm of the initial 80 ppm lindane concentration in the treated soil have diffused into the formerly untreated soil. The diffusion rate then decreases rapidly. The dependency of the diffusion coefficient on concentration and time may be explained by the fact that lindane will reach maximal vapor density in the range of 20 to 30 ppm. After these concentrations are built up in the initially untreated half-cells by diffusion, vapor diffusion approaches zero and all the diffusion is in the 'nonvapor' phase. At a 10% soil water content, 50% of the lindane diffuses in the vapor phase and 50% in the 'nonvapor' phase. At near saturation, total diffusion is in the 'nonvapor' phase. Lindane diffusion in soils can easily change from 'nonvapor' to vapor phase and back to 'nonvapor' phase. (Knapp-USGS)
W69-09477

LINDANE DIFFUSION IN SOILS:[2]. WATER CONTENT, BULK DENSITY, AND TEMPERATURE EFFECTS,
California Univ., Riverside. Dept. of Soils and Plant Nutrition; and Agricultural Research Service, Riverside, Calif.
Wilfried Ehlers, W. J. Farmer, W. F. Spencer, and J. Letey.
Soil Sci Soc Amer Proc, Vol 33, No 4, p 505-508, July-Aug 1969. 4 p, 3 fig, 4 tab, 9 ref. USDA Contract 12-14-100-9016 (41).

Descriptors: *Diffusion, *Adsorption, *Insecticides, *Soils, *Pesticide kinetics, Soil water movement, Path of pollutants, Mass transfer, Thermodynamic behavior, Chlorinated hydrocarbon pesticides, Saturated flow, Unsaturated flow.
Identifiers: *Lindane.

The diffusion of lindane in Gila silt loam is strongly influenced by soil water content, bulk density, and temperature. The diffusion coefficient is nearly zero in soil of 1% water content. With an increase in .3% water content, which is equivalent to 2 layers of water between the montmorillonite clay plates, water is able to displace the lindane the adsorbing surface so that the diffusion c cient becomes maximal. A small additiona crease in water content reduces the diffusion ficient to about one-half of the maximal value. value then remains constant with increasing content up to saturation. Decreasing bulk de or increasing temperature raises the diffusion ficient. The influence of bulk density and tem ture on diffusion is in good agreement theoretical calculations. (Knapp-USGS)
W69-09478

VAPOR DENSITY OF SOIL-APPLIED D DRIN AS RELATED TO SOIL-WATER C TENT, TEMPERATURE, AND DIELDRIN C CENTRATION,
California Univ., Riverside. Dept. of Soils and Nutrition; and Agricultural Research Se Riverside, Calif.
W. F. Spencer, M. M. Cliath, and W. J. Farmer
Soil Sci Soc Amer Proc, Vol 33, No 4, p 509 July-Aug 1969. 3 p, 4 fig, 9 ref.

Descriptors: *Dieldrin, *Vapor pressure, moisture, *Pesticide kinetics, Drying, Evapora Water loss, Volatility, Pesticide residues, physics, Soil chemistry.
Identifiers: Vapor density (Pesticides), HEOD

Vapor densities of dieldrin, which consists cipally of HEOD or hexachloroepoxyoctahyd do, exo-dimethanonaphthalene in dieldrin-soil tures increased with temperature and dieldrin centration but were not affected by soil-water tent until the water content decreased below equivalent of one molecular layer of water. densities dropped to very low values when water content fell below this level, but incre again as water was added to the dry soil, indic that the drying effect is reversible. When more a monomolecular layer of water was present soil, vapor density increased, with increasing concentration until a saturation vapor de equal to that of HEOD without soil was reach approximately 25 ppm HEOD. This implies surface applications of dieldrin and probably similar chlorinated hydrocarbon insecticides volatilize as rapidly from mineral soils as fro pure materials until the concentration at the face fails to relatively low levels. Loss of wa not required for significant rates of volatilizati occur from soils or other surfaces on which can successfully compete for adsorption sites napp-USGS)
W69-09479

OXYGEN UPTAKE RATES OF BENT DEPOSITS ON THE UPPER PASSAIC RIVE
Rutgers - The State Univ., New Brunswick, N.J
O. M. Donovan, and J. V. Hunter.
Paper presented at ASME/AIChE Water Poll Conference, June 1969. Publ by Water Reso Research Institution, Rutgers University, 196 p, 5 tab, 4 fig, 17 ref. FWPCA Contract 1 DUP.

Descriptors: *Benthos, *Water pollu *Biochemical oxygen demand, Oxygen deman
Identifiers: *Oxygen demand, Benthal, Be respirometer, Stream bottom, Oxygen balance ygen sink.

An in situ benthal respirometer was utilize determine benthal oxygen demands on the Pa River near Little Falls, New Jersey. Diff deposits on the stream were examined. Thes hibited demands ranging from 1.13 g/m2-da 3.79 (2)-day, with an average demand of g/m2-day. These demands were then exan from the viewpoint of their effects upon the ox stream oxygen balance. It was found that benthic demand upon the supernatant ranged from 0.261 mg/1-day at a flow rate o cfs to 0.120 mf/1-day at flow rate of 140 These data are presented in tabular and gr forms in subsequent sections of this paper. (W ple-Rutgers)

A 69-09557

AQUIFER BEHAVIOR WITH INJECTION,
Petrobras Co., and Texas A and M Univ., College Station.
For primary bibliographic entry see Field 04B.
W69-09650

AGRICULTURE'S CONTRIBUTION TO THE FERTILIZATION OF CANAL LAKE,
Guelph Univ. (Ontario). Dept. of Soil Science.
For primary bibliographic entry see Field 05C.
W69-09662

EFFECT OF VARIOUS FACTORS ON MOVEMENT OF NITRATE NITROGEN IN SOIL PROFILES AND ON TRANSFORMATIONS OF SOIL NITROGEN,
Wisconsin Univ., Madison.
R. J. Olsen.
Univ of Wisconsin, Water Resources Center, Report 1969. 79 p. OWRR B-004-Wis.

Descriptors: *Nitrification, *Soil nitrogen, *Public health, *Soil leaching, Groundwater, Soil profiles, Water table, Surface runoff, Farm wastes, Aerobic conditions, Incubation.
Identifiers: *Lake eutrophication, *Soil phosphorus, Alfalfa-bromegrass, Spring thaws, Fertilizer-nitrogen.

There is increasing evidence that agriculture is contributing to the increase in nitrate-nitrogen in streams, lakes, and domestic water supplies. High amounts of nitrate-nitrogen in water are a health hazard and contribute to lake eutrophication. Methods by which nitrogen may enter the water from agricultural sources include the leaching of nitrate-nitrogen through the soil profile to the water table and surface runoff, especially during spring thaws from manure applied to frozen soil during the winter. The data obtained from field experiments indicate that pollution of groundwater with nitrate-nitrogen can be limited by avoiding excessive rates of fertilizer nitrogen; providing a crop cover on the soil during the growing season; use of hay crops, such as alfalfa-bromegrass, in rotation with corn or other crops receiving fertilizer nitrogen; and not permitting unprotected manure to accumulate during the time of year when leaching can occur. Recovery of fertilizer nitrogen by three successive corn crops and as soil inorganic nitrogen following the last crop ranged from 72 to 88 percent. The average concentration of nitrate-nitrogen in the soil solution at the lowest profile depth sampled ranged from 14 ppm for virgin soils to 21 ppm for manure contaminated soils and to 33 ppm for cultivated soils. Rate of nitrification was directly related to the rate of manure application, presence of aerobic conditions, period of incubation, and soil phosphorus. The average recovery of nitrogen by chemical analysis of the soil receiving the higher manure rates after 37 weeks of incubation ranged from 24% for anaerobic conditions to 73 to 80 percent for the aerobic conditions. These data suggest that where animal manure is not to be used as a fertilizer, lagooning of the manure under anaerobic conditions may be an effective method of disposal with a minimum risk of water pollution. (Olsen-Univ of Wis)
W69-09721

CHEMICAL REACTOR THEORY APPLIED TO MODELING THE DYNAMICS OF A CONTROL SYSTEM FOR WATER QUALITY OF A RIVER; PHASE I--A FEASIBILITY STUDY,
Maine Univ., Orono.
Edward G. Bobalek, Kenneth I. Mumme, and Ronald A. Lewis.
Proj Completion Rept, Maine Water Resources Center, Jul 1967. 39 p, Stab, 8 fig, 39 ref, 2 append. OWRR Proj B-001-ME.

Descriptors: *Computer models, Mixing, Waste dilution, *Control systems.
Identifiers: *Penobscot River Estuary, Dynamic system, Residence times.

This study was aimed to provide an exploratory appraisal of the feasibility of conducting an extensive experimental probing of a selected river system. Such experiments would have the ultimate goal of providing an accurate and workable model of one typical system in the State of Maine. Such a model would be used to implement an overall control scheme which can provide a basis for engineering decisions on regulating waste discharges into the river under conditions which do not overload the capability of the river to purge itself so as to restore water qualities affected by pollution loading. The Penobscot River estuary was selected as representative of conditions existing in the state with respect to water pollution. Existing models are inadequate for several reasons in analysing this type of dynamic estuary system. Feasibility of alternative approaches was explored by using computer simulations which attempted to predict the chemical reactor performance of the river assuming reasonable values of input variables.
W69-09731

CHEMICAL REACTOR THEORY APPLIED TO MODELING THE DYNAMICS OF A CONTROL SYSTEM FOR WATER QUALITY OF A RIVER; PHASE II--STUDY OF A RIVER SYSTEM AS A CHEMICAL REACTOR,
Maine Univ., Orono.
Edward G. Bobalek.
Proj Completion Rept, Me Water Resour Center, Aug 1969. 21 p, 5 fig. OWRR Proj B-003-ME.

Descriptors: *Computer models, Mixing, Waste dilution, *Control systems.
Identifiers: *Penobscot River Estuary, Dynamic system, Residence times.

Phase II (OWRR: B-003-ME), which extends the study of Phase I (OWRR: B-001-ME), projects the modelling of a river system as a tubular chemical reactor which can purge itself of oxidizable organics if scheduling of pollution inputs from known sources is guided by a feed-forward control scheme which responds to continuous monitoring of the chemical kinetics profile of the river system. The data requirements of the tentative river model proposed in Phase I has served its primary objective in guiding design, construction and performance testing under real and simulated service conditions of an instrumental, hardware system for continuous acquisition of data on salinity, temperature and oxygen content with depths at variable sampling sites. Although this first model was the basis for establishing requirements for river analysis, further developments of the pollution abatement goals are no longer dependent on adequacy of this first approximation to modelling. Comprehensive control schemes have been developed which are applicable to any adequate river model which can evolve from a history of data acquisition. At the conclusion of Phase II, the progress achieved is (1) Application of control theory, supported by software development, to make possible testing and validation of any tentative river model as a basis for a feed-forward control scheme. (2) Placement of four variants of pilot models of hardware systems into service for long-term performance evaluation in continuous acquisition, transmission, storage and processing of data which define the down-stream reaction potential of the river. Phase III (OWRR: B-005-ME), to validate the technical feasibility of the control schemes and to generate and appraise adequacy of improved river models is now continuing in the 25-mile tidal reach of the Penobscot River between the Bangor dam and the throat of Penobscot Bay at Bucksport, Maine.
W69-09732

RADIUM IN NATURAL WATERS IN THE UNITED STATES,
Geological Survey, Washington, D.C. Water Resources Div.
For primary bibliographic entry see Field 05C.
W69-09744

WILL THE USE OF 2,4,5-T TO CONTROL STREAMSIDE VEGETATION CONTAMINATE PUBLIC WATER SUPPLIES,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station; Pennsylvania State Univ., University Park, Pa.; and Amchem Products, Inc., Ambler, Pa.
Irvin C. Reigner, William E. Sopper, and Roy R. Johnson.
Journal of Forestry, Vol 66, No 12, p 914-918, December 1968.

Descriptors: *Watershed management, *2-4-5-T, *Herbicides, *Riparian plants, Water yield improvement, Water supply, Organoleptic properties, Odor, Taste, Domestic water, Water quality, Brush control, Phenolic pesticides, New Jersey, Pennsylvania.

Riparian vegetation along two small headwater streams in Pennsylvania and New Jersey was treated with 2,4,5-T. Water samples were collected immediately after treatment and periodically thereafter for three weeks. Odor tests were used to determine the degree of contamination. Results indicated that only slight contamination occurred within the treated sections of streams immediately after treatment and in two instances after the first large storm. No contamination was detected downstream. Vegetation analysis one year after treatment indicated that the ester formulation had completely killed 70 to 81 percent of the stems and that the emulsifiable acid had killed 58 to 78 percent. Results of this study provide additional evidence that phenoxy herbicide, if applied with normal precautions, can be used on municipal watersheds without creating any water contamination.
W69-09763

POLLUTION OF WATER FROM AGRICULTURAL SOURCES,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
Lloyd L. Harrold.
The Ohio Engineer, Vol 29, No 4, p 10, Apr 1969. 16 p, 3 ref.

Descriptors: *Water pollution, *Agricultural chemicals, *Fertilizer, *Animal waste, *Water pollution sources, Leaching, Streamflow, Erosion.
Identifiers: *Farm chemicals, *Food production, Automatic sampler.

USA became the world's foremost food quality and quantity producer by use of farm fertilizer and other chemicals. Phosphate fertilizer and dieldrin pesticide attach to soil and do not dissolve readily in runoff water. They become a significant part of the pollution of water bodies only as soil is eroded by runoff water. Nitrate fertilizer polluts surface and subsurface water bodies where excessive amounts are applied and under high rates of rain and irrigation. It is water soluble. Beef cattle feedlots of over 70,000 head in one unit raised the nitrate content of the soil 20 feet deep to a maximum of 5,000 pounds per acre. Research is defining the involvement of agriculture in the pollution problem by determining the fate of agri-chemicals applied on farm lands and the effects of animal wastes. It is also developing cropping systems and other means for stabilizing pollutants from agricultural operations.
W69-09767

5C. Effects of Pollution

POLLUTION AND EUTROPHICATION PROBLEMS OF GREAT SOUTH BAY, LONG ISLAND, NEW YORK,
New York State Dept. of Conservation, Ronkonkoma.
Jack Foehrenbach.
J Water Pollut Contr Federation, Vol 41, No 8, Part 1, p 1456-1466, Aug 1969. 11 p, 4 fig, 1 tab, 16 ref.

Descriptors: *Eutrophication, *Bays, *Farm wastes, Poultry, Water pollution sources, Water pollution effects, Dissolved oxygen, Oxygen demand, Streamflow, Sport fishing, Commercial fishing, Recreation, Ecology, Economics, Fisheries, Pesticides, Waste water disposal.
Identifiers: *Great South Bay, Long Island (NY).

Great South Bay is located midway between New York City and Montauk Point. Each year sport fisheries gross $4,539,000. In addition, 53,400 lb of finfish ($12,000) and 4,792,000 lb of shellfish ($4,250,000) are harvested. Because of poor recirculation and small inflow of tidal waters, the creek flows of 24 million cu ft/day and groundwater flows of 28 million cu ft/day are helping to increase the nutrient content of the 92-sq mile bay, much of which is less than 8 ft deep. Although the bay has a large assimilative capacity for some forms of pollution, it is reaching a point where additional loads will affect adversely its ecology, economic, and recreational value. (Knapp-USGS)
W69-09453

PHOTOSYNTHETIC OXYGEN PRODUCTION IN A POLLUTED TROPICAL ESTUARY,
Asian Inst. of Tech., Bangkok (Thailand). Dept. of Environmental Engineering.
M. B. Pescod.
J Water Pollut Contr Federation, Vol 41, No 8, Part 2, p R309-R321, Aug 1969. 13 p, 11 fig, 3 tab, 11 ref. Proj No 34/3.

Descriptors: *Photosynthetic oxygen, *Reaeration, *Tropical regions, *Estuaries, *Water pollution effects, Turbidity, Oxygen demand, Nutrients, Photosynthesis, Oxygen sag, Solar radiation, Plankton, Phytoplankton, Productivity.
Identifiers: *Thailand, *Chao Phya River, Tropical estuaries.

Interference with light transmission by turbidity severely restricts phot osynthetic oxygenation in the Chao Phya River estuary in Thailand. Light and dark bottle studies indicated that oxygen production by phytoplankton was normally from 0.5 to 1.3 mg/l/day at the river surface and fell off to 0 at a depth of 1.0 to 1.5 m. Gross photosynthetic oxygen production at a heavily polluted section of the river ranged from 0.20 to 0.78 g/day/sq m, which supplied only 1.25 to 4.6% of the oxygen demand. An average rate of photosynthetic oxygen production of more than 0.014 mg/l/day should not be assumed in oxygen balance calculations for alluvial tropical rivers. (Knapp-USGS)
W69-09455

CONCEPTS OF FECAL STREPTOCOCCI IN STREAM POLLUTION,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Cincinnati Water Research Lab.
For primary bibliographic entry see Field 05B.
W69-09456

EFFECT OF ENVIRONMENTAL FACTORS ON BENTHAL OXYGEN UPTAKE,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering and Dow Chemical Co., Midland, Mich. Waste Treatment Div.
Archie J. McDonnell, and S. Douglas Hall.
Res supported by funds from OWRR, Dept of Interior. J Water Pollut Contr Federation, Vol 41, No 8, Part 2, p R353-R363, Aug 1969. 11 p, 7 fig, 5 tab, 20 ref. OWRR Contract 14-01-001-983.

Descriptors: *Oxygen demand, *Benthic fauna, *Benthic flora, *Decomposing organic matter, *Respiration, Biodegradation, Eutrophication, Water pollution effects, Aquatic microorganisms, Oxygen requirements, Sedimentation, Water temperature, Oxygen sag, Water quality.
Identifiers: Oxygen uptake.

The study was conducted to define the effects of oxygen concentration, temperature, and biological community on the oxygen demand of benthal deposits sampled from a mildly polluted eutrophic stream. Six-inch diam (15.2-cm) plastic cylinders were filled with benthal material from 2-, 12-, 15-, and 25-cm depths and mixed constantly in a dark environment. Results show that oxygen uptake varied according to oxygen concentration. Uptake was independent of sample depth--microbial concentration accounted for 45- to 48-percent respiration and invertebrate respiration, 52-55%. Uptake rates varied from 0.0001 to 0.0005. A two-fold biological rate increase was noted with a 10 C temperature rise. (Knapp-USGS)
W69-09457

EFFECT OF SLUDGE DEPTH ON OXYGEN UPTAKE OF A BENTHAL SYSTEM,
Perkins (Dana F.) and Sons, Inc., Reading, Mass.; and Tufts Univ., Medford, Mass.
Robert I. Davison, and N. Bruce Hanes.
Water and Sewage Works, Vol 116, No 8, p 301-306, Aug 1969. 6 p, 10 fig, 4 tab, 14 ref. Grant No 5T1-WP-40-05 (FWPCA).

Descriptors: *Oxygen demand, *Sludge, *Streams, *Water pollution effects, Biochemical oxygen demand, Biodegradation.
Identifiers: Sludge depth-oxygen demand relations.

A laboratory study was made of the effect of sludge depth on the oxidation rate of a benthal sludge deposit. The depths of sludge studied were 1.6, 15.2, and 30.5 cm in reactors each of which consisted of an annular chamber between 7 inch outside diameter and 8 3/4 inch inside diameter plexiglas cylinders, a magnetic stirrer, a thermistor, and an oxygen probe. Temperatures were controlled by running the experiments in a walk-in incubator. Experimental data are tabulated and shown graphically. Deeper sludge deposits exert a significantly greater oxygen uptake than shallower deposits. After consolidation of a sludge deposit, oxygen uptake is independent of depth. In a stream deposit, if the sludge is not agitated by stream turbulence or bubbling, depth and oxygen uptake are probably independent. (Knapp-USGS)
W69-09474

AGRICULTURE'S CONTRIBUTION TO THE FERTILIZATION OF CANAL LAKE,
Guelph Univ. (Ontario). Dept. of Soil Science.
F. R. Campbell, and L. R. Webber.
J Soil and Water Conserv, Vol 24, No 4, p 139-141, Aug 1969. 3 p, 2 fig, 2 tab, 9 ref.

Descriptors: *Eutrophication, *Nutrients, *Water pollution sources, *Agriculture, Nitrogen, Phosphorus, Fertilizers, Runoff, Farm wastes, Productivity, Aquatic plants.
Identifiers: *Canal Lake (Ontario).

Water quality, weed growth, and nutrient loadings of Canal Lake, Ontario were studied between May and November 1968. Relatively little nitrogen and phosphorus are contributed by the area's low-level agriculture. Precipitation contributes more nitrogen than streams. Agriculture contributes about 0.15 lb/acre, about a twentieth of the yield from an equivalent nonfertilized area. Most nitrogen probably comes from lake sediments, plants, and fixation of nitrogen in the lake. About 84% of the phosphorus probably originates in a lake upstream of Canal Lake. The agricultural yield is only about 63 lb from 30,000 acres. These contributions, of nutrients are negligible considering the total nutrients in the lake, the nutrient load of the streams and other sources of nutrients. (Knapp-USGS)
W69-09662

SEASONAL FLUCTUATIONS OF LAKE MICHIGAN DIATOMS,
Bureau of Commercial Fisheries, Ann Arbor, Mich.
For primary bibliographic entry see Field 02H.
W69-09679

A SURVEY OF THERMAL POWER PLA COOLING FACILITIES,
Federal Water Pollution Control Administrati Portland, Oreg.; Washington State Water Pollut Control Commission; and Washington Office of Quality Control, Olympia.
Robert W. Zeller, Herbert E. Simison, E. Jack Weathersbee, Harold Patterson, and George Hansen.
Pollut Contr Counc Rep, Pacific Northwest A Apr 1969. 54 p, 19 fig, 1 tab.

Descriptors: *Thermal powerplants, *Cool water, *Thermal pollution, *Surveys, Cooli Water cooling, Cooling towers, Heated water, dustrial water, Water pollution sources, Water p lution effects.
Identifiers: Powerplant cooling waters.

A tour of 5 mine-mouth coal-fired powerplant the eastern U.S., a gas/oil plant at Long Bea California, and a nuclear power plant at San C mente, California was made in 1968 to st methods of heat disposal. The information is to used to predict impact on air and water quality proposed powerplants in the Pacific northwest U.S. The coal-fired plants use cooling towers ponds because local surface water sources are adequate in quantity for once-through cooling. cooling towers and ponds all perform economic and satisfactorily, and cause no increased ic precipitation or weather problems in their lo areas. The coastal nuclear and gas/oil plants once-through cooling by seawater and coa freshwater. There are no evident water qua problems, particularly because local sport fishin for subtropical fish which are tolerant of w ranges of water temperature. (Knapp-USGS)
W69-09681

THE ENVIRONMENT AND PLANKTON DEN TY IN MISSOURI RIVER RESERVOIRS,
Bureau of Sport Fisheries and Wildlife, Yankton Dak.
For primary bibliographic entry see Field 02H.
W69-09709

USE OF ENDOCOMMENSAL MOLLUSC CILIATED PROTOZOA AS INDICATORS WATER QUALITY AND POLLUTION IN LINOIS WATERS,
Illinois Univ., Urbana. Water Resources Center
For primary bibliographic entry see Field 05A.
W69-09718

EFFECT OF VARIOUS FACTORS ON MO MENT OF NITRATE NITROGEN IN S PROFILES AND ON TRANSFORMATIONS SOIL NITROGEN,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 05B.
W69-09721

EUTROPHICATION FACTORS IN NOI CENTRAL FLORIDA LAKES,
Florida Univ., Gainesville. Engineering and In trial Experiment Station.
P. L. Brezonik, W. H. Morgan, E. E. Shannon, a H. D. Putnam.
Engineering Progress in Florida. Bull Series No and Water Resources Research Center Pub N Gainseville, Florida, Aug 1969. 101 p, 50 fig tab, 124 ref, 4 append. Grant DON 16, 010 (FP CA). OWRR Project A-002-FLA.

Descriptors: Water quality, *Eutrophication, A blooms, Nutrients, Limnology, Dystro Oligotrophy, *Primary productivity, *Tro level, Water storage, Evaporation, Water cir tion, Sediments.
Identifiers: Seepage losses, Diurnal variations.

A small lake in an uninhabited drainage bas north Florida is being used as a model for eutrophication research described in this re An adjacent lake serves as the control. Backgr

on the chemistry and biology of the lakes were
ined in order to be certain of their similarity
trophic status. Water and nutrient budgets
e determined and nutrient enrichment (treated
age effluent) has been continuous since March
7. Both routine monitoring and special (10
) studies were carried out in both lakes com-
ing the experimental system. In 1968 the
arch program was extended to include other
s of various types and exhibiting varying
hic stages in North Central Florida. The
ophic lakes in the Oklahoma chain are in-
ed. Changes in parameters have been and are
inuing to be determined and related to the
ient flux. Systems analysis techniques have
applied. Appendices include methods of
nical analyses; biological procedures, a listing
rotozoa, microscopic algae and sulfur bacteria
rded from the experimental and control lakes
ive dates, and the multiple regression analyses
ormed on ten day study data and routine
thly data.
9-09723

OUNDWATER POLLUTION (IN A REVIEW
THE LITERATURE OF 1965 ON WASTE
TER AND WATER POLLUTION CON-
OL),
vaii Univ., Honolulu. Water Resources
earch Center.
B. Ewing, and L. Stephen Lau.
10 in Water Resources Research Center's
nd volume of Collected Reprints, Vol I. Journal
ne Water Pollution Control Federation, Vol 38,
7, Jul 1966. p 1110-1117, 59 ref. OWRR Proj
01-HI.

criptors: *Groundwater, *Pollution, *Litera-
review.

review covers literature of groundwater pollu-
in the following subjects: (1) reported cases of
ution by chemical plant wastes, irrigation
er, detergent, refuse dumps, fruit processing
tes, and spent pulp liquors, radioactive wastes,
effects on groundwater by disposal of treated
age effluents through spreading on ground, by
osal of oil field brines by deep wells and by
age lagooning, (3) construction of disposal
, (4) recharge basin and ground disposal
ems, (5) effects on groundwater by ground-
er recharge practices in California and Israel,
laboratory studies of travel through soils of bac-
a, BOD, algae, manganese, iron, and
onuclides and of adsorption of ABS and car-
ylic acids by clay and soil, (7) theoretical stu-
of dispersion, (8) field investigations of ABS
ution, (9) methods for site evaluations for
nd disposals, and (10) legal and administrative
cts.
9-09733

OUNDWATER POLLUTION (IN A REVIEW
THE LITERATURE OF 1966 ON WASTE
TER AND WATER POLLUTION CON-
OL),
vaii Univ., Honolulu. Water Resources
earch Center.
tephen Lau, and Ben B. Ewing.
1-40 in Water Resources Research Center's
nd volume of Collected Reprints, Vol I. Journal
ne Water Pollution Control Federation, Vol 39,
7, Jul 1967. p 1124-1131, 62 ref+ add ref.
RR Proj A-001-HI.

criptors: *Groundwater, *Pollution, *Litera-
review.

1966 review covers literature of groundwater
ution in the following subjects: (1) ground
osal facilities, (2) geology, (3) reclamation and
tewater disposal, (4) pollutants and (5) legisla-
. Fifty-nine publications are cited.
9-09734

GROUNDWATER POLLUTION (IN A REVIEW OF THE LITERATURE OF 1967 ON WASTE WATER AND WATER POLLUTION CONTROL),
Hawaii Univ., Honolulu. Water Resources Research Center.
Ben B. Ewing, and L. Stephen Lau.
p 109-117 in Water Resources Research Center's bound volume of Collected Reprints, Vol I. Journal of the Water Pollution Control Federation, Vol 40, No 6, June 1968. p 1075-1081, 56 ref. OWRR Proj A-001-HI.

Descriptors: *Groundwater, *Pollution, *Literature review.

The 1967 review covers literature of groundwater pollution in the following topics: (1) municipal sources, (2) industrial sources, (3) groundwater recharge, (4) dispersion, (5) chemistry of groundwater, (6) pollutants and (7) seawater intrusion.
W69-09735

THE STRONTIUM AND CALCIUM RELATIONSHIPS IN CLINCH AND TENNESSEE RIVER MOLLUSKS,
Oak Ridge National Lab., Tenn. Radiation Ecology Section.
D. J. Nelson.
Proc 1st Nat Symp on Radioecology, Colorado State Univ, Fort Collins, Sept 10-15, 1961. Radioecology, Reinhold Pub Corp, NY and Amer Inst of Biological Sciences, Wash, DC, Schultz, Vincent and Klement Jr, Alfred W (eds), p 203-211, 1963. 1 fig, 8 tab, 19 ref.

Descriptors: *Strontium radioisotopes, *Calcium, *Mollusks, *Tennessee River, Clams, Growth rates, Sampling, Radioactivity, Stable isotopes, Ecosystems, Tracers, Bioindicators, Age, Flame photometry, Spectrophotometry, Fallout, Tennessee.
Identifiers: *Clinch River (Tenn), *Oak Ridge National Laboratory (Tenn), Shells, Species differences, Surface, Specific activity, Sphaeriidae, Physidae, Anodonta corpulenta, Quadrula pustulosa, Elliptio dilatatus, Elliptio crassidens, Pleurobema cordatum, Fusconaia subrotunda, Megalonaias gigantea, Actinonaias carinata gibba, Ligumea recta latissima, Lampsilis ovata, Dromus dromas, Quadrule metanevra, Amblema costata, Cyclonaias tuberculata, Plagiola lineolata, Proptera alata.

Shells of 16 species of clams were analyzed for calcium, strontium, and strontium-90 to determine content of these elements and strontium isotope as functions of species and location, and feasibility of their use as biological indicators of strontium-90. Calcium content was about 40% of ash weight; average strontium contents ranged from 156 to 382 micrograms per gram. Differing contents are due to inherent differences between species rather than to environmental ratios of strontium to calcium. Strontium content of clam shells increases with their growth rate and with reduced ratio of surface to volume. These factors do not explain strontium content of all species. Inherent species differences may be related to nonhomogeneous distribution of strontium within shells. Low-level releases of strontium-90 by Oak Ridge National Laboratory were used as tracers to determine behavior of strontium-90. On basis of dilution of Clinch River waters by the Tennessee, observed atomic ratios of strontium-90 to stable strontium agreed well with those expected in shells. This agreement suggests that clams may be useful samplers of strontium-90, and that strontium-90 released in Clinch River is in equilibrium with living and non-living components of the river system. (See also Vol 2, No 19, Field 5C, W69-07863). (Jones-Wis)
W69-09741

NATURAL RADIOACTIVITY IN THE FOOD WEB OF THE BANDED SCULPIN COTTUS CAROLINAE (GILL),
Louisville Univ., Ky. Dept. of Biology.
W. L. Minckley, J. E. Craddock, and L. A. Krumholz.
Proc 1st Nat Symp on Radioecology, Colo State Univ, Fort Collins, Sept 10-15, 1961. Radioecology, 1963, Reinhold Pub Corp, NY and Amer Inst of Biological Sciences, Wash DC, Schultz, Vincent and Klement Jr, Alfred W (Eds) p229-236. 8 fig, 4 tab, 13 ref.

Descriptors: *Sculpins, *Radioactivity, *Food webs, Kentucky, Life history studies, Gamma rays, Spectrometers, Cyanophyta, Uranium radioisotopes, Strontium radioisotopes, Cesium, Fallout, Silts, Detritus, Bottom sediments, Chutes, Eddies, Habitats, Crayfish, Growth stages, Diatoms, Algae, Metabolism, Isopods, Amphipoda, Fish, Growth rates.
Identifiers: *Cottus carolinae, Mead County (Ky), Thorium-232, Bismuth-214, Actinium-228, Swift riffles, Zirconium-95, Niobium-95, Ruthenium-106, Rhodium-106, Cerium-144, Beta radioactivity, Goniobasis, Decapoda, Plecoptera, Ephemeroptera, Tipulidae, Chironomidae, Half-life.

Consideration of life history and radioecology of banded sculpin (Cottus carolinae) reveals that most radioactivity results from natural decay; some, from fallout. Biota of the ecosystem accumulate measurable amounts. In the food web of Cottus carolinae, radioactivity concentrates at the producer level, with decreased amounts at higher trophic levels involving animals. Animals, fed mostly on diatoms and blue-green algae, generally contained the most radioactivity. Vertebrates, and larger invertebrates contained radioactivity with levels varying according to size of individual animal. Smaller animals contained more radioactive materials per unit weight than larger ones. Actual metabolic changes seem to be as important in determining amount of retention and accumulation of radiomaterials as are amounts of the radiomaterials ingested. Similarly, cumulative amounts of radioactivity taken in as food, compared with ever-increasing body burden, allow calculation of percentage of ingested radioactivity retained in the body. Percentages are relatively high during early life of sculpins, decreasing just before maturity, and increasing slowly throughout remainder of life. Lack of major variations in this level of retention indicate a certain metabolic need, or somewhat constant metabolic accumulation, which comprises approximately 2% of total radiomaterials ingested. (See also Vol 2, No 19, Field 5C, W69-07683). (Jones-Wis)
W69-09742

THE FATE OF RADIOSTRONTIUM IN A FRESHWATER COMMUNITY,
Atomic Energy of Canada Ltd., Chalk River (Ontario). Biology and Health Physics Div.
Ivan L. Ophel.
Proc 1st Nat Symp on Radioecology, Colo State Univ, Fort Collins, Sept 10-15, 1961. Radioecology, Reinhold Pub Corp, NY and Amer Inst of Biological Sciences, Wash, DC, Schultz, Vincent and Klement Jr, Alfred W (Eds), P 213-216, 1963. 5 fig, 2 tab, 4 ref.

Descriptors: *Strontium radioisotopes, *Freshwater, *Ecosystems, Lakes, Acidity, Calcium, Perches, Bullheads, Shiners, Otters, Muskrats, Mink, Beavers, Radioactivity, Seepage, Disposal, Tritium, Cobalt radioisotopes, Radioactive wastes, Sampling, Seasonal, Minnows, Clams, Bottom sediments, Plankton, Cesium.
Identifiers: *Chalk River (Canada), Atomic energy of Canada, Brasenis, Nymphaea, Potamogeton, Pontederia, Typha, Scirpus, Myrica, Ceratophyllum, Lepomis Procyon, Yttrium-90, Ruthenium-106, Sulfur-35, Half-life, Bone, Concentration factor.

Strontium-90 has been followed through a stream-fed ecosystem containing dissolved radionuclides from seeps in a liquid disposal area of the Canadian Atomic Energy establishment. Amounts entering Perch Lake during five years and leaving by an outlet stream were measured. Strontium-90 (Sr-90)

content in the bones of adult perch increased gradually over a four-year period, reaching equilibrium the fifth year. Most of accumulated radiostrontium is retained in the skeleton and a considerable fraction in adult fish bone is non-exchangeable. When the concentration factor for perch flesh is only five, that for bone is 3,000. Transmission of radiostrontium and radiocesium can be compared thus: for water containing the (then) maximum permissible concentration of cesium-137 (Cs-137), maximum permissible body burden of Cs-137 for man would be contained in 20 grams of fish flesh, while maximum permissible body burden of Sr-90 would be contained in 100 kilograms of perch flesh. It would seem, therefore, that the major pathway of radiostrontium--in contrast to radiocecium--to man from a contaminated body of water would be from direct use of water for drinking, rather than by way of food webs originating in the aquatic environment. (See also Vol 2, No 19, Field 5C, W69-07863). (Jones-Wis)
W69-09743

RADIUM IN NATURAL WATERS IN THE UNITED STATES,
Geological Survey, Washington, D.C. Water Resources Div.
Robert C. Scott.
Proc 1st Nat Symp on Radioecology, Colo State Univ, Fort Collins, Sept 10-15, 1961. Radioecology, Reinhold Pub Corp, NY and Amer Institute of Biological Sciences, Wash DC, Schultz, Vincent and Klement Jr, Alfred W (Eds), p 237-240, 1963. 3 fig, 7 ref.

Descriptors: *Radium radioisotopes, *Groundwater, *United States, *Radioactivity, Sampling, Aquifers, Public health, Geological surveys, Kansas, Oklahoma, Missouri, Colorado, New Mexico, Iowa, Illinois, Minnesota, Wisconsin, Michigan, Indiana, Kentucky, Freshwater, Brackish water, Deep wells, Geochemistry, Geologic formations, Shales, Uranium radioisotopes, Limestones, Sandstones, Stock water, Domestic water, North Carolina, South Carolina, Texas, Maine, New Hampshire.
Identifiers: Drinking water, Mississippi Valley, Cambrian, Ordovician, Brine water, Thorium.

Author reports on radium concentrations in groundwater exceeding, on the average, 3.3 micromicrocuries per liter and are considered anomalous. In formations of Cambrian and Ordovician age of the upper Mississippi Valley, in Iowa and Illinois, such anomalous concentrations exist. This area, underlain by high-radium water in aquifers, extends into Minnesota, Wisconsin, the northern Michigan peninsula, and across Indiana into northern Kentucky. However, samples from wells in northeastern Iowa, northern Illinois, and northward to the outcrop formations of Cambrian and Ordovician in Minnesota and Wisconsin generally contained less radium. Of the Roubidoux Formation and Cotter Dolomite of Early Ordovician age, perhaps a southward extension of the anomalous radium area of upper Mississippi Valley, in Kansas, Oklahoma, and Missouri, samples of freshwater with high radium were taken from municipal wells. High-radium water in limestones and sandstones occurs between an outcrop area receiving freshwater recharge and deeply buried parts of the aquifers containing high-radium brines. Of the Cheyenne Sandstone Member of the Purgat oire Formation of Early Cretaceacus age in southeastern Colorado and New Mexico, many wells yield water containing anomalous amounts of radium. Other high-radium areas have been found in the United States. (See also Vol 2, No 19, Field 5C W69-07863). (Jones-Wis)
W69-09744

USE OF LIGHT NUCLIDES IN LIMNOLOGY,
Yale Univ., New Haven, Conn. Geochronometric Lab.; and Yale Univ., New Haven, Conn. Dept. of Geology.
Edward S. Deevey, Jr., Minze Stuiver, and Noboyuki Nakai.
Proc 1st Nat Symp on Radioecology, Colo State Univ, Fort Collins, Sept 10-15, 1961. Radioecology, 1963, Reinhold Pub Corp, NY and Amer Institute of Biological Sciences, Wash, DC, Schultz, Vincent and Klement Jr, Alfred W (Eds), p 471-475. 5 fig, 12 ref.

Descriptors: *Limnology, *Radioactivity, *Carbon, *Carbon radioisotopes, *Sulfur, Lakes, Hypolimnion, Ecosystems, Connecticut, Methane, Carbonate rocks, Fallout, Pondweeds, Groundwater, Mud, Fermentation, Phytoplankton, Sulfates, Rainwater, Metabolism, New York, Analytical techniques, Radioecology.
Identifiers: *Light nuclides, Nuphar, Linsley Pond (Conn), Queechy Lake (NY).

Authors' first studies on carbon in lakes resulted from a search of error in radi ocarbon dating sources. A study of carbon-13 in five lakes, differing in hardness and size, showed carbon in the hypolimnion as, at least, a three-component system: carbon dioxide from spring circulation, oxidation of seston in the water, and anaerobic fermentation in mud. Correction must be made for carbonate rock as source by distinguishing carbonate carbon from fermentation carbon by its carbon-14 content. Carbon-14 studies indicate presence of radiocarbon from nuclear detonations with seasonal fluctuation of fallout. Bomb radiocarbon enters lakes soft enough to be sensitive to labelled atmospheric carbon. Depletion of carbon-14 in deep water suggests that fermentation is active or works on mud whose average carbon is old enough, or that groundwater is similarly depleted (although the lakes are supposedly insulated from groundwater by clay basinseal). Input and distribution of sulfur-34 within lakes is much like carbon. Major source of sulfur, except where rocks are rich in sulfate, is from air as sulfur dioxide. Agricultural fertilizer, sulfur introduced as sea-spray, and industrial sulfur are not probable sources; best explanation for sulfur-enrichment is that lakes are ecosystems metabolizing sulfur. (See also Vol 2, No 19, Field 5C, W69-07863). (Jones-Wis)
W69-09745

THE PRESENT STATE OF LAKE ZURICH (IN GERMAN),
Kantonales Laboratorium, Zurich (Switzerland). Limnologische Abteilung.
For primary bibliographic entry see Field 02H.
W69-09746

THE IONIC COMPOSITION OF LAKE WATERS,
Uppsala Univ. (Sweden). Inst. of Limnology.
For primary bibliographic entry see Field 02H.
W69-09747

SEDIMENTATION IN ARTIFICIAL LAKES,
Soil Conservation Service, Washington, D.C.
For primary bibliographic entry see Field 02H.
W69-09748

THE CALCIUM, MAGNESIUM, POTASSIUM, AND SODIUM BUDGETS FOR A SMALL FORESTED ECOSYSTEM,
Dartmouth Coll., Hanover, N.H. Dept. of Biological Sciences.
For primary bibliographic entry see Field 02K.
W69-09750

THE CONCEPT OF PRODUCTIVITY IN BIOLOGY (GERMAN),
For primary bibliographic entry see Field 02K.
W69-09751

INCREASE IN THE CONTENT OF ORTHOPHOSPHORUS AS AN EXPRESSION OF PROGRESSIVE EUTROPHICATION OF LAKE CONSTANCE (GERMAN),
Institut fur Seenforschung und Seenbewirtschaftung Langenargen am Bodensee.
For primary bibliographic entry see Field 02H.
W69-09752

IONIC COMPOSITION OF SAGEHEN CRE CALIFORNIA, FOLLOWING AN ADJACI FIRE,
California Univ., Berkeley. Dept. of Soils and P Nutrition; and California Univ., Berkeley. Dep Zoology.
For primary bibliographic entry see Field 02K.
W69-09753

CHEMICAL INVESTIGATION OF LAKE SE MENTS AND THEIR INTERPRETATION,
Freshwater Biological Association, Winderm (England).
For primary bibliographic entry see Field 02H.
W69 09754

MODE OF FILAMENTOUS GROWTH OF L COTHRIX MUCOR IN PURE CULTURE A IN NATURE, AS STUDIED BY TRITIAT THYMIDINE AUTORADIOGRAPHY,
Indiana Univ., Indianapolis. Dept. of Microbiolo
Thomas D. Brock.
Journal of Bacteriology, Vol 93, No 3, p 985-9 March 1967. 3 fig, 5 tab, 11 ref.

Descriptors: *Bacteria, *Cultures, *Triti Epiphytology, Marine algae, Ecology, Nutrie Seawater, Organic compounds, Habitats, Statist methods.
Identifiers: *Leucothrix mucor, *Growth, *I ments, *Autoradiography, Antithamnion niense, Tritiated glucose, Gonidia formation, L Island Sound (NY), Iceland, Tritiated thymid Narragansett Bay (RI), Cape Reykjanes (Icela Sudurnes (Iceland), Non-parametric tests, C Sample Runs Test, Cluster analysis, Reykjavik (land).

Growth mode of Leucothrix mucor filaments measured by autoradiography with triti thymidine. Studies were performed on L muco pure cultures in free suspension, as an epiphyt pure culture of the red alga Antithamnion niense, and as an epiphyte of red algae in the Statistical analyses of growing cells distribution performed by use of the nonparametric One-S ple Runs Test and a Cluster analysis adapted f quadrat analyses of plant ecologists. No evide of preferential growth at base or tip of L mucor ments was obtained in any of these studies. H ever, in nature, but not in the laboratory, t were regions of L mucor filaments which were growing or dormant. Such nongrowing reg could incorporate tritiated glucose. In labora culture of Leucothrix on Antithamnion, Leucot cannot grow alone in the medium (ASP-6) in w the alga grows, but only when attached to alga. algae seemingly released nutrients into the w where complete mixing occurs. All regions of terial filaments should have equal access to nutrient supply and there should be no preferen growth at the base. In nature, epiphytic bac probably derive their nutrients from seaw (Jones-Wis)
W69-09755

5D. Waste Treatment Processes

THE ROLE OF ALGAE IN DEGRADING I TERGENT SURFACE ACTIVE AGENTS,
Texas Univ., Austin. Dept. of Civil Engineering
Ernst M. Davis, and E. F. Gloyna.
J Water Pollut Contr Federation, Vol 41, N Part 1, p 1494-1504, Aug 1969. 11 p. 4 fig. 5 21 ref. Grant No NSF-GU-1963.

Descriptors: *Biodegradation, *Algae, *Aq bacteria, Detergents, Surfactants, Alkylben sulfonates, Linear alkylate sulfonates, Water p tion effects, Stabilization, Lagoons, Toxi Waste water treatment, Waste water disposal.
Identifiers: *ABS, LAS.

e rates of degradation of 3 typical nonionic and nionic surfactants by green and blue-green algae re evaluated. Additional data were gathered for ganisms obtained from raw wastewater, activated dge, and waste stabilization pond water. Results w that algae contribute to a small extent in the gradation of common household detergents. st degradation is attributed to bacteria or other ganisms. Algae did not degrade alkyl benzene fonate while bacteria did (0.45 mg/l/day). The er anionic surfactant, linear alkyl sulfonate, was graded in small amounts by some of the different al forms (0.97 mg/l/day by bacteria). Nonionic ergents were more easily degraded. (Knapp-GS)
69-09454

IE INDIRECT CYCLE OF WATER REUSE,
nford Univ., Calif. Dept. of Environmental En-eering.
orge Tchobanoglous, and Rolf Eliassen.
ter and Wastes Eng, Vol 6, No 2, p 35-41, Feb 69. 7 p, 8 fig, 4 tab, 26 ref.

scriptors: *Water reuse, *Reclaimed water, rificial recharge, Recharge wells, Water spread-, Water quality, Water treatment, Sewage treat-nt, Economics, Water supply.
ntifiers: Indirect cycle reuse.

e indirect cycle may be defined as the return of ter used one or more times to hydrologic and tural cycles for reuse. Treated wastewater is urned through the indirect cycle by surface reading, direct injection, and seepage from pits d septic tank leaching fields. Technical factors t must be considered include the rate of applica-n, the characteristics of the recharge site, quality d quantity requirements, and the availability of table treatment processes. The economic feasi-ity of the indirect reuse of reclaimed water is sed on an analysis of the cost effectiveness of the atment processes used to reclaim it, the cost of nsporting and recharging it, and the cost of alter-tive sources of supply. In the future, the applica-n of reclaimed water for groundwater replenish-nt and the control of salt water intrusion will in-ase as greater demands are placed on existing undwater reserves. (Knapp-USG S)
69-09495

STREAM AERATION OF POLLUTED VERS,
tgers - The State Univ., New Brunswick, N.J. ater Resources Research Inst.
r primary bibliographic entry see Field 05G.
69-09555

SURVEY OF THERMAL POWER PLANT OLING FACILITIES,
deral Water Pollution Control Administration, rtland, Oreg.; Washington State Water Pollution ntrol Commission; and Washington Office of Air ality Control, Olympia.
r primary bibliographic entry see Field 05C.
69-09681

ORM DRAINAGE ASPECTS OF THE DEEP NNEL PLAN,
uer Engineering Inc., Chicago, Ill.
J. Bauer.
oc AISI Seminar, Ill Inst Technol, Oct 8, 1968. p, 10 fig, 5 tab.

scriptors: *Water pollution control, *Storm ru-ff, *Pumped storage, *Tunnels, *Illinois, droelectric power, Water storage, Costs, Cost-nefit analysis, Storm drains, Retention.
ntifiers: *Chicago deep tunnel plan.

e proposed Chicago deep tunnel plan would pro-le temporary storage of storm runoff from com-ned sewers to allow steady low-volume treatment d prevent discharge of raw sewage to surface ters. The total cost is estimated to be 242-446 million dollars. Operating costs are expected to be very low because the facility will be large enough to use profitably as a peak-demand pumped storage hydroelectric plant. Storm runoff will be only a small part of the total movement of water. The design and cost analysis of the project are described briefly. (Knapp-USGS)
W69-09690

TREATMENT AND DISPOSAL OF RADIOACTIVE WASTES,
E. Ya. Spitsyn.
Transl from Atomizdat, Moskva, 1965. 102 p, 40 fig, 15 tab, 44 ref, 1 append. Available from the Clearinghouse as TT No 68-50326, $3.00 in paper copy, $0.65 microfiche.

Descriptors: *Radioactive waste disposal, *Waste treatment, Coagulation, Ion exchange, Biodegradation, Evaporation, Underground storage, Injection wells, Safety, Waste dilution, Nuclear wastes, Waste dumps, Waste storage, Solid wastes.
Identifiers: *USSR, Radioactive waste handling.

The disposal of radioactive wastes has always received considerable attention and supervision in the USSR. Norms were introduced and basic regulations promulgated for the disposal of radioactive wastes into the atmosphere, water bodies, and into the soil. The considerable experience that has since been accumulated in the USSR in the design and construction of the necessary radioactive-waste disposal installations and structures is discussed in a textbook which includes descriptions of the techniques for the collection, processing, transportation, and burial of solid and liquid radioactive wastes. Some elementary concepts of nuclear physics, basic definitions, and terminology are given. The techniques of processing liquid and solid wastes are described and technical aspects and health hazards are discussed. Recommendations for the selection of equipment and examples of various calculations are given. The selection on 'cooling' of radioactive wastes is more detailed than the rest of the chapter since the published information on this subject is not sufficient for practical purposes. The transportation and burial techniques of radioactive wastes are described from design data as well as from data provided by the existing burial grounds for radioactive wastes. (Knapp-USGS)
W69-09717

5E. Ultimate Disposal of Wastes

TREATMENT AND DISPOSAL OF RADIOACTIVE WASTES,
For primary bibliographic entry see Field 05D.
W69-09717

5F. Water Treatment and Quality Alteration

EVOLUTION OF WATER QUALITY GOALS,
Elwood L. Bean.
Journal of the American Water Works Association, Vol 61, No 7, p 317-320, Jul 1969. 4 p, 11 ref.

Descriptors: *Water quality, *Attitudes, History, Administration, Standards, Water works, Water costs, Water quality control, Test procedures, Toxicity, Organic matter, Corrosion, Insecticides, Zeta potential, Nitrates, Nitrites, Viruses.
Identifiers: *Goals, Demand for quality, AWWA Committee on Water Quality Goals.

The article evaluates USPHS water quality standards and relates the rise of new standards. The recent work of an AWWA committee to establish higher standards emphasizes that water must be not only safe, but also clear, palatable, nonstaining and noncorrosive, and not too hard. AWWA has recommended the committee's goals to the water industry. The burden of action is on individual water suppliers, who are responsible to their consumers. Many consumers may stifle attempts for higher quality water because of the common conception of water as 'cheap.' Water works management, which has educated the public toward low cost, should reorient consumers toward quality and create a customer demand for better water. The AWWA Committee on Water Quality Goals has begun a survey to determine the field status of water quality control. Other research needs include: simpler tests to measure corrosivity, toxics and organic constituents; insecticide hazards; refined measurement of either zeta or streaming potentials; effects of minerals on health; reduction of schistosomiasis; nitrate-nitrite dangers; virus control; and improved sensors for monitoring water. (Gossen-Chicago)
W69-09564

ALTERNATIVES IN WATER SUPPLY,
Daniel A. Okun.
Journal of the American Water Works Association, Vol 61, No 5, p 215-221, May 1969. 7 p, 29 ref.

Descriptors: *Dual system, Water quality, Viruses, Chemical degradation, Aesthetics, Attitudes, Education, Pricing, Costs, Automation, Technology, Water sources, Human resources.
Identifiers: Utility tunnels, Regional administration.

After reviewing unmet PHS standards and confronting the possibilities of disease caused by public water, the author discusses three aspects of public water supplies: viruses in water; chemicals in water; and esthetic quality. The dangers of viruses and chemicals may be more far-reaching than they appear. Esthetic quality is so low that a dissatisfied public is turning more and more to bottled water. The recommended action is to establish a dual water supply. Drinking water would be of highest quality, taken from naturally pure sources or produced from brackish or seawater. The second supply might be of questionable quality and esthetically less desirable, but it would be bacteriologically safe through conventional treatment that includes disinfection. Implementation could be achieved by public education or by a discriminating pricing policy. Costs of dual supplies would not differ significantly from conventional systems. Future trends are discussed, including: utility tunnels; automation; regionalization of public water management; new water sources available through technology, and greater utilization of human resources. The article is followed by two discussions of the article: one by Samuel S. Baxter, one by Henry J. Graeser and Albert H. Halff. (Gossen-Chicago)
W69-09566

STATE LABORATORY OF HYGIENE.

N C Gen Stat secs 130-30, 130-31 (1964), as amended, (Supp 1967).

Descriptors: *North Carolina, *Administrative agencies, *Public health, *Water supply, Legislation, Regulation, Analysis, Potable water, Sanitary engineering, Water quality, Water pollution, Environmental sanitation, Microorganisms, Inspections, Water quality control.
Identifiers: Hygiene.

A State Laboratory of Hygiene under the control of the State Board of Health is establihed for the better protection of the public health. All public water supplies shall be examined monthly. Water supplies furnishing potable water to ten or more residences or businesses are deemed a public water supply. In addition, all waters sold in bottle or package and all spring waters maintained for human consumption shall be examined monthly by the laboratory. Any other waters shall be examined when a specimen is sent to the state laboratory by a local health director or licensed physician. When examinations indicate the presence of intestinal organisms or other evidence of contamination, notice

shall be sent to the suppliers and examinations shall then be made weekly until evidence of contamination is no longer present. (Childs-Fla)
W69-09584

5G. Water Quality Control

PESTICIDES IN SELECTED WESTERN STREAMS-A PROGRESS REPORT,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 05A.
W69-09447

LINDANE DIFFUSION IN SOILS:[1]. THEORETICAL CONSIDERATIONS AND MECHANISM OF MOVEMENT,
California Univ., Riverside. Dept. of Soils and Plant Nutrition; and Agricultural Research Service, Riverside, Calif.
For primary bibliographic entry see Field 05B.
W69-09477

LINDANE DIFFUSION IN SOILS:[2]. WATER CONTENT, BULK DENSITY, AND TEMPERATURE EFFECTS,
California Univ., Riverside. Dept. of Soils and Plant Nutrition; and Agricultural Research Service, Riverside, Calif.
For primary bibliographic entry see Field 05B.
W69-09478

VAPOR DENSITY OF SOIL-APPLIED DIELDRIN AS RELATED TO SOIL-WATER CONTENT, TEMPERATURE, AND DIELDRIN CONCENTRATION,
California Univ., Riverside. Dept. of Soils and Plant Nutrition; and Agricultural Research Service, Riverside, Calif.
For primary bibliographic entry see Field 05B.
W69-09479

AID TO MUNICIPALITIES FOR WATER POLLUTION CONTROL.

NH Rev Stat Ann secs 149-B:1 thru 149-B:3 (1964), as amended, (Supp 1967), secs 149-B:4 thru 149-B:5 (Supp 1967).

Descriptors: *New Hampshire, *Cities, *Sewage treatment, *Water pollution, Legislation, Federal government, State governments, Cost sharing, Construction, Water pollution control, Regulation, Engineering, Treatment facilities, Sewers, Public health, Administrative agencies, Surface waters, Cost repayment, Disposal, Amortization, Installation, Maintenance, Operating costs, Grants, Legal aspects, Costs, Sewage disposal.

The state of New Hampshire shall, in addition to the federal grant, pay annually 30% of the yearly amortization charges on the original costs resulting from the acquisition and construction of sewage disposal facilities by municipalities for the control of water pollution. The approval of such construction must first be obtained from the Water Pollution Commission. Those municipalities that began construction of their facility before July 1, 1947 shall be entitled to receive their full costs retroactively. Any municipality which qualified for state contribution shall receive an additional 10% amortization from the state yearly. All pollution control facilities must be installed in accordance with specifications approved by the Water Pollution Commission, and failure to comply with such plans will result in the loss of payments to the municipality. (Shevin-Fla)
W69-09523

MARINE TOILETS AND DISPOSAL OF SEWAGE FROM BOATS.
NH Rev Stat Ann 149-A:1 thru 149-A:11 (1964), as amended, (Supp 1967).

Descriptors: *New Hampshire, *Water pollution sources, *Boats, *Sewage disposal, Recreation, Water sports, Regulation, Transportation, Bodies of water, Water pollution, Wastes, Organic wastes, Sewage, Ships, Sewage treatment, Legislation, Legal aspects, Administrative agencies, Permits, Inspection.
Identifiers: *Marine toilets, Penalties (Civil).

No marine toilet on any boat shall be so constructed or operated as to discharge any sewage into waters of the state. Any marine toilet shall have a suitable treatment device constructed and operated in compliance with regulations of the Water Supply and Pollution Control Commission. No sewage from any toilet with a treatment device shall be discharged within 500 feet of the shoreline. Violators of this provision shall be fined. All boats located on the waters of the state shall be subject to inspection by the Commission to insure compliance with these provisions. All boats having a marine toilet must be registered with the Department of Safety. The registration certificate of any boat not properly equipped with a marine toilet as herein described shall be suspended until the discrepency is remedied. The registered owner of any boat having its registration certificate suspended shall be notified and shall have the right to a hearing on the suspension. (Helwig-Fla)
W69-09524

INSTREAM AERATION OF POLLUTED RIVERS,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
W. Whipple, Jr., J. V. Hunter, B. Davidson, F. W. Dittman, and Shaw L. Yu.
Available from the New Jersey Water Resources Research Institute for $2 per copy. Water Resources Research Institute, Rutgers - The State University of New Jersey, New Brunswick, Aug 1969. 196 p, 41 tab, 56 fig, 78 ref. FWPCA 16080 DUP.

Descriptors: *Aeration, *Dissolved oxygen, *Water quality control, *BOD, *Optimization, Oxygen, Oxygen sag, Water pollution treatment, Water quality, Optimum development plans, Systems analysis.
Identifiers: *Instream aeration, *Induced aeration, *BOD mass balance, Mechanical aerator, Diffused aerators, Dynamic simulation.

Mechanical and diffuser instream aerators were tested on the Upper Passaic River and proved a practical and economical method of adding dissolved oxygen to polluted streams. The tests were conducted in conjunction with research into photosynthesis, benthal oxygen demand, and mass balance of BOD in that river system. Systems of aerators were designed to provide for meeting water quality objectives of dissolved oxygen, and cost estimates made. Alternative costs of meeting the same objectives by means of advanced effluent treatment alone appear to be several times as great. It is concluded that instream aeration may provide a feasible alternative to advanced waste treatment for polluted rivers, as a supplement to secondary waste treatment.
W69-09555

ENGINEERING APPLICATION OF MULTIVARIABLE DISTRIBUTED PARAMETER CONTROL THEORY,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
For pri mary bibliographic entry see Field 06A.
W69-09559

POLLUTION AND ENVIRONMENTAL QUALITY,
Resources for the Future, Inc., Washington, D.C.
Robert U. Ayres, and Allen V. Kneese.
IN The Quality of Urban Environment: Essays on 'New Resources' in an Urban Age, p 35-71, edited by Harvey S. Perloff, Resources for the Future, Inc. The Johns Hopkins Press, Baltimore, 1969. 37 p fig, 10 tab.

Descriptors: *Management, *Planning, *Qual control, *Waste disposal, Pollution, Air pollutic Water pollution, Solid wastes, Marketing, Costs.
Identifiers: *Total environmental approach, *E vironmental planning, *Environmental quali Reprocessing, Interdependencies.

Traditionally environmental pollution has been a proached in a fragmented way; air, water, a solids pollution are each dealt with separately. T discussion is organized in terms of the main sect of the economy which produce waste, particula urban areas, and an attempt is made to look at t waste problem in its entirety. Environmental pol tion and its control is viewed as a materials balan problem for the entire economy. Detailed empi cal estimates of actual discharges of residuals to t environment and a discussion of some technologi for their modification is given. Using a schema residual materials flow for the household sect excluding automobiles, the interdependencies the various waste streams is shown. The point made that our market mechanism fails to deal a propriately with the entire resources allocati problem and does not adequately reflect the co of disposing of residuals, including any costs to t overall society associated with their discharge in the environment. Two ways of dealing with t problem are given. Both call for internalizing t problem to take account of all costs and benefi The system to be used in reorganizing our soc policy to produce different relative burdens bei placed on various residual receiving environmen media is described. (Marriott-Chicago)
W69-09563

ECONOMIC FRAMEWORK FOR SALINI CONTROL PROJECTS,
Philip J. Coffey, and Leonard Ortolano.
Journal of the American Water Works Associati Vol 61, No 5, p 237-241, May 1969. 5 p, 2 fig tab, 16 ref.

Descriptors: *Water quality control, *Econo efficiency, Salinity, Project planning, Hardn (Water), Costs, Benefits, Optimization.

The article focuses on determining the degree water quality enhancement that should be provi where salinity is the major quality indicat Benefits are perceived as costs avoided downstream users due to salinity reduction. purpose of this article is to suggest a design for economically efficient control program. Analysi limited to the case where loads and level of wa use are constant. A n analogy is made between method and the techniques used in planning fl protection. Section I discusses special problems mineral pollution control. Section II describes proposed method for relating costs of salinity c trol to water quality. The method fulfills economic criteria established by the Preside water resources council in 1962: (1) total tangi benefits exceeding costs; (2) marginal benefits each separable unit of a project exceeding its c and (3) scope of development sufficient to m imize net benefits. Section III applies the meth Section IV discusses the value and limitations the method. It should be useful in developing a p gram to relieve a current condition of saline po tion. It will not give answers for situations that volve a developing basin economy. (Goss Chicago)
W69-09565

POLLUTION: REGULATION AND THE TITRUST LAWS,
Philip K. Verleger, and Jennie M. Crowley.
Nat Resources Lawyer, Vol 11, No 2, p 131-1 May 1969. 11 p, 46 ref.

Descriptors: *Air pollution, *Legislation, *Reg tion, *Administrative agencies, Clean Air A Public health, Public rights, Pollution, Industr

leral government, State governments, Institu-
al constraints, Solvents, Judicial decisions,
al aspects, Water pollution, Political aspects,
ial aspects.
ntifiers: *Antitrust laws, Sherman Act, Clayton
, Federal Trade Comm'n Act.

e to the great masses of industry, the pollution
blem has become acute. A number of regulato-
agencies have been designed to deal with the
blem. However, regulation does not gain quality
en imposed without the guidance of those regu-
d. The author feels that the only way to a solu-
n is through consultation between industry and
ernment and among industries themselves. It is
his point that the problem of antitrust violations
ers. Under the Sherman Act, the Clayton Act,
the Federal Trade Commission Act, any con-
ation among industry in relation to business
ctices may be subject to attack as a violation of
itrust laws. The government has refused to grant
se industries immunity from prosecution, and as
esult they shy away from consultation. Cases
ling with antitrust violations are studied in the
cle. The author feels that the right to col-
orate in dealing with the government is absolute
that such collaboration is the key to pollution
trol. (Shevin-Fla)
69-09577

ATER AREAS BEAUTIFICATION.
primary bibliographic entry see Field 06E.
69-09587

VERS, HARBORS.

Ann Code art 27 secs 482, 484, 485 (1957).

scriptors: *Maryland, *Pollution abatement,
iparian rights, *Mining, Legislation, Rivers, Har-
rs, River beds, Oysters, High water mark, Public
hts, Legal aspects, Docks, Dredging, Excavation,
ds, Navigable rivers, Sands, Gravels.
ntifiers: *Public landings, Chesapeake Bay.

s unlawful to cast or unload any ballast, ashes,
h, earth, oysters, or oyster shells from any ship
other vessel in Chesapeake Bay above 'Sandy
int' or in the waters of Herring Bay or in any
er, creek, or harbor within this state below the
h water mark. Damaging or destroying the use-
ness of any public landing or wharf or other
ucture erected on said wharf is unlawful. The
noval of sand, gravel, or other material from the
d of any navigable rivers, creeks, or branches of
state is unlawful. However, it is lawful for any
arian owners or their agents to dig, dredge, take
d carry away sand, gravel or other materials from
bed of the river opposite the riparian land from
high water mark to the outer line of the nearest
annel. (Childs-Fla)
69-09595

LLUTION OF SOURCES OF WATER
PPLY.

Ann Code art 27 sec 583 (1957).

scriptors: *Maryland, *Water supply, *Water
llution sources, *Pollutants, Legislation, Legal
pects, Pollution abatement, Water pollution,
astes, Streams, Wells, Springs, Reservoirs, Water
urces, Industrial wastes, Potable water, Organic
stes, Cesspools, Sewage, Water pollution con-
l, Water quality.

e placing of any dead animal or part thereof or
y decayed or filthy animal or vegetable matter in
y stream, well, spring, reservoir, pond or other
urce of water or ice to be used for drinking or
mestic purposes is unlawful. Similarly, the allow-
of any sewage, washings, or other offensive
tter from any privy, cesspool, factory, or other
ce to flow into any pipe whereby any water
pply is fouled is a punishable offense. (Childs-
)
69-09596

MUNICIPAL AND COUNTY GOV'T (SEWAGE SYSTEM).
Vt Stat Ann tit 24, secs 3501-3508 (1959).

Descriptors: *Vermont, *Sewage, *Sewage disposal, *Cities, Legislation, Regulation, Waste disposal, Wastes, Sewage treatment, Administrative agencies, Administrative regulations, Facilities, Local governments, Utilities, Public utilities, Taxes, Water rates.
Identifiers: Domestic sewage, Storm water, Storm sewage, Sanitary sewage, Sanitary treatment.

A municipal corporation may construct, maintain, and operate a sewage system and is authorized to purchase or acquire necessary real estate and easements. The municipal corporation may contract to make disposal of domestic or storm water sewage. The property owner using the sewage system shall be liable for rent, such rent being a lien on the real estate furnished with the service. The municipal corporation may purchase and hold realty and personalty and may levy and collect taxes necessary for the payment of the expenses and indebtedness of such sewage system. A board of sewage systems commissioners is created to supervise the municipal systems and to establish all needed rates for rent, with rules and regulations for its control and operation. (Moulder-Fla)
W69-09618

MAKING DRAINS, ROADS OR RAILROADS.

Ill Ann Stat ch 94, sec 1 (Smith-Hurd 1950).

Descriptors: *Illinois, *Ditches, *Mine drainage, *Eminent domain, Mining, Drainage, Water conveyance, Land tenure, Legislation, Legal aspects, Mine water, Mine wastes, Conveyance structures.

If a mine cannot be conveniently worked without a ditch which must necessarily pass through land owned and occupied by others to drain or convey water, the mine owner may resort to the law of eminent domain to construct the ditch upon such land. (Breeze-Fla)
W69-09622

BRADY V SPRINGDALE (CONDEMNATION ACTION FOR DESTRUCTION OF SPRINGS).
441 SW 2d 81-84 (Ark 1969).

Descriptors: *Arkansas, *Condemnation, *Springs, *Sewage disposal, Legal aspects, Judicial decisions, Condemnation value, Air pollution, Sewage, Sewage treatment, Easements, Eminent domain, Sewers, Cities, Pipes, Water pollution, Water pollution effects, Air pollution effects, Spring waters, Damages, Land tenure, Underground, Contracts, Tiles, Engineering structures, Waterworks, Odors.

Defendant condemned a permanent easement through plaintiff's land and plaintiff brought this action to recover damages for diminished value of the remaining land. Plaintiff claimed a reduction in the value of his land due to destruction of a spring and air pollution over his property from defendant's sewage disposal facility. A jury trial resulted in an award of $750 as compensation for the easement. Plaintiff appealed seeking a new trial. The court held that the jury's verdict would not be disturbed unless it was clearly erroneous. The court found that the testimony at the trial was conflicting both as to the nature of the spring which was allegedly destroyed, and as to the offensiveness of the odor from the sewage plant. The court held that in view of this conflicting evidence, the jury was justified in reaching its conclusion and the verdict was affirmed. (Shevin-Fla)
W69-09625

WATER POLLUTION CONTROL.
Iowa Code Ann secs 455B.1 to 455B.28 (Supp 1969).

Descriptors: *Iowa, *Water pollution control, *Water quality control, *Standards, Legislation, Administrative agencies, Water quality, Impaired water quality, Project planning, Legal aspects, Permits, Waste disposal, Sewage disposal, Regulation, Water conservation, Water resources development.

Iowa public policy is to conserve state waters and to protect, maintain, and improve the quality thereof; to prevent the discharge of inadequately treated waste; to provide for the control of water pollution; and to cooperate with state and federal agencies toward these objectives. The Iowa Water Pollution Control Commission is created with the powers and duties: (1) to supervise and enforce all laws relating to water pollution; (2) to develop comprehensive programs for water pollution control; (3) to cause the state Department of Health to conduct investigations; (4) to establish water quality standards; (5) to require the filling of disposal systems plans for approval or disapproval; (6) to direct the regulation of permits relating to waste or sewerage discharge and installation of disposal systems; and (7) to hold hearings. In establishing quality standards, the Commission should consider the public health, the nature of the water, the character and use of the adjacent land, the past, present and potential uses of the water, the extent of natural contamination, and the extent to which solids bacteria, organisms, toxic substances, and oxygen demanding substances should be permitted. (Marsee-Fla)
W69-09631

DRAINAGE OF COAL AND MINERAL LANDS AND MINES.
Iowa Code Ann secs 468.1 to 468.9 (1949).

Descriptors: *Iowa, *Surface drainage, *Mine drainage, *Compensation, Payment, Exploitation, Land tenure, Mineral industry, Coal mines, Eminent domain, Right-of-way, Condemnation, Legislation, Relative rights, Drainage programs.

Any person or corporation owning or possessing land underlaid with coal which cannot be mined due to an accumulation of surface water, may drain the water over the surface of land belonging to another upon agreement or judicial determination by condemnation of the damages to be paid for such drainage. Any person or corporation which in any way removes water from lead or zinc bearing lands to make them productive, shall receive on demand 1/10 of any lead or zinc removed therefrom. The person entitled to 1/10 of the minerals may examine the mines and premises of the owner, and if the owner at any time obstructs the exercise of the right to 1/10 of the minerals, a double recovery shall be allowed. Any person holding a 1/10 drainage compensation right may garnishee minerals from smelters upon notice. Any person or corporation engaged in draining lead or zinc bearing lands may obtain necessary rights of way in order to convey water from the land, with damages determined by agreement or judicially through eminent domain. No landowner is compelled by this chapter to remove minerals from his land. (Harris-Fla)
W69-09636

PUBLIC HEALTH AND SAFETY.
Ark Stat Ann sec 41-3301 (1964).

Descriptors: *Arkansas, *Animals, Public health, Streams, Bodies of water, Legislation, Water law, Pollution, Water pollution, Water pollution sources.
Identifiers: *Penalties (Criminal), Misdemeanor.

The throwing or dragging of dead or dying animals into any running stream or other body of water in the state of Arkansas is unlawful. Violation of this act is punishable by fine. (Holt-Fla)
W69-09646

WATER POLLUTION IN REMOTE RECREATIONAL AREAS,
Forest Service (USDA), Duluth, Minn. Superior National Forest.
Michael A. Barton.
J Soil and Water Conserv, Vol 24, No 4, p 132-134, Aug 1969. 3 p, 4 photo, 1 tab, 7 ref.

Descriptors: *Water pollution control, *Recreation wastes, Waste disposal, Nutrients, Sediments, Water pollution sources, Pesticides.
Identifiers: *Wilderness areas.

Continued population expansion and increased leisure time and affluence will require that wilderness areas absorb greater and greater use. These areas must be protected if they are to survive. Too often wilderness environments are ecologically delicate. Using standards of clean water normally considered appropriate in water quality control programs, wilderness waters could be degraded significantly before uses other than recreation would be damaged. Little consideration is given to nutrient enrichment in formulating standards. Greater emphasis must be accorded nutrients, the aquatic growths they produce, and the impact nutrients have on aesthetic qualities. Special standards must be formulated and strictly enforced in wilderness areas. (Knapp-USGS)
W69-09661

GROUNDWATER APPRAISAL OF THE LITTLE WABASH BASIN ABOVE THE GAGE BELOW CLAY CITY AND THE LOUISVILLE RESERVOIR SITE, ILLINOIS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W69-09693

THE MILWAUKEE RIVER,
Milwaukee River Technical Study Committee, Wis.
For primary bibliographic entry see Field 06B.
W69-09703

QUALITY OF SURFACE WATER IN ILLINOIS, 1956-1966,
Illinois State Water Survey, Urbana. Water Supply Div.
For primary bibliographic entry see Field 02E.
W69-09739

EFFECT OF RECREATION ON WATER QUALITY,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
Irvin C. Reigner.
Univ. Mass. Coop. Ext. Serv. Pub. 446: 49-55, 1966. (Municipal Watershed Management Symposium Proceedings, 1965).

Descriptors: *Watershed management, *Recreation, *Water quality, Recreation demand, Fishing, Boating, Camping, Swimming, Aesthetics, Land use, Multiple-purpose projects, Recreation facilities, Reservoirs, Golf courses, Northeast U.S., New England.

Although forested municipal watersheds in the Northeast offer possibilities for both land and water recreation, their use has been limited by the necessity to protect water quality. Reviewing the impact of various kinds of recreation on water quality leads to the conclusion that, while recreation has not seriously degraded public water supplies, this has only been due to the determined effects of municipal authorities to prohibit or minimize recreation on watersheds and reservoirs. Increasing pressures for recreation may be met by assigning a recreation specialist to the staff of the water supply administrator. More research is needed both in the detection and treatment of pollutants, in the location of recreational facilities, and the control of recreationists; this review of current conditions helps set the stage for future research.
W69-09762

POLLUTION OF WATER FROM AGRICULTURAL SOURCES,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 05B.
W69-09767

ECONOMIC INCENTIVES AND WATER QUALITY MANAGEMENT PROGRAMS,
Wisconsin Univ., Madison.
Ved Prakash, and R. H. Morgan, Jr.
Univ of Wisconsin, Water Resources Center, Report, May 1969. 74 p.

Descriptors: *Tax incentives, *Effluent charges, *Regional systems, *Efficiency, Federal government, Wisconsin, Sewage service charges, Optimal water quality.
Identifiers: *Economic incentives, Wisconsin.

Alternative programs for water quality management are examined from efficiency, equity and financing viewpoints. The programs examined include various direct regulatory policies, tax incentives, investment credits and loan programs, effluent charges and regional systems. Both Federal and Wisconsin fiscal incentives are analyzed as to their effect on the behavior of waste producers. Effluent charges and the problem of their implementation are discussed. A review of sewage service charges is used as a background for regional water quality systems employing joint treatment facilities. Effluent charges are also discussed as a method of financing joint facilities using either marginal or average pricing schemes.
W69-09769

DAMAGE TO WATER, FLOOD CONTROL STRUCTURES, OR FISH.

Ark Stat Ann secs 4-4401 thru 4-4419 (1964), as amended, (Supp 1967).

Descriptors: *Arkansas, *Pollution abatement, *Alteration of flow, *Obstruction to flow, Mississippi River, Pollutants, Water pollution, Poisons, Fish, Fish barriers, Fish conservation, Dams, Check structures, Levees, Drains, Overflow, Embankments, Shore protection, Rivers, Streams, Bridges, Navigable rivers, Legislation, Legal aspects.
Identifiers: *Natural drains, Injunctions (Prohibitory), Penalties (Criminal).

It is unlawful to obstruct in any manner any natural drain, but this provision does not apply in certain enumerated counties. It is also unlawful to fail to keep any dam open to the extent necessary to permit a flow of water sufficient to maintain fish life in the stream below such dam. It is unlawful to poison any lake or stream. Any person who wilfully injures any structure erected to create hydraulic power to prevent the overflow of lands is guilty of a misdemeanor, but such injury to a public levee is a felony. Any person who attempts to change the course of the Mississippi River is guilty of a felony, and provision is made for injoining such an attempt. It is made unlawful to remove gravel from the beds and bars of the White River. It is likewise unlawful to leave timber in any navigable stream. (Keith-Fla)
W69-09782

RECREATIONAL ACTIVITIES NEAR WATER SUPPLY.

Ark Stat Ann secs 19-4232, 19-4233, 19-4234 thru 19-4236, 19-4238.2, 19-4271 (1968).

Descriptors: *Arkansas, *Recreation, *Water supply, *Water resources, Water pollution, Water quality, Water policy, Public health, Water utilization, Water pollution control, Waterworks, Nonconsumptive use, Natural use, Competing uses, Camping, Swimming, Water sports, Legislation, Legal aspects, Administrative agencies, Leases, Construction, Reservoirs.

The operating authority of any municipally-own waterworks which maintains adequate pollut control may permit recreational activities upon t lands and waters maintained for waterworks pu poses. The authority may construct recreation facilities, collect fees and rentals, and prescri rules and regulations governing recreational acti ties. The rules shall have the force of law within t operating authority's jurisdiction, but are subo dinate to those of the Game and Fish Commissi in the area of hunting and fishing. Wading swimming is prohibited in certain lakes, reservoi and nonnavigable streams above a water intake an impounding dam used by a municipality f water supply. Camping on non-federal land with drainage areas for reservoirs, lakes or non-navig ble streams from which the water supply is taken prohibited. The operating authority may lease la for recreational purposes and may allow constru tion of recreational facilities. The Board of Heal may enjoin the operating authority from permitti recreational activities if the water supply is n being adequately protected from pollution. All m nicipalities may permit construction or relocati of waterworks or sewers by the United States connection with flood control or other project (Kelly-Fla)
W69-09789

NORBECK VILLAGE JOINT VENTURE MONTGOMERY COUNTY COUNCIL (ZONI AS WATERSHED MANAGEMENT).
254 A2d 700-706 (Md 1969).

Descriptors: *Maryland, *Zoning, *Polutan *Watershed management, Legal aspects, Judic decisions, Regulation, Urbanization, Local gover ments, Administrative agencies, Sewers, Pollut abatement, Sewage, Sewage treatment, Water p lution sources, Waste treatment, Sewage dispos Basins, Watersheds (Basins), Water pollutio Water pollution control, Public health.

Plaintiffs were landowners in Montgomery Cou who desired their land to be zoned as a high dens residential area. Defendant County Council h filed a master zoning plan which called for pla tiffs' land to be zoned as a low density residenti area. The stated purposes of defendant's mast plan were the preservation of open spaces and pr tection of the watershed area from pollution caus by inadequate sewage processing facilities. T court noted that the test of the validity of a co prehensive rezoning is whether it bears a substa tial relationship to the public health, comfo safety, convenience, and general welfare. T court found that defendant's master plan met t test of validity and held for the defendant. (Keit Fla)
W69-09791

STATE JUDICIAL DETERMINATION RIGHTS RELATIVE TO DIFFUSED SURFA WATERS, NATURAL GROUND WATERS, A TIFICIAL WATERCOURSES, AND OTH COMMON LAW PRINCIPLES,
Minnesota Univ., Minneapolis. Water Resourc Research Center.
For primary bibliographic entry see Field 06E.
W69-09796

ASPECTS OF STATE STATUTES I,
Minnesota Univ., Minneapolis. Water Resourc Research Center.
For primary bibliographic entry see Field 06E.
W69-09797

POISONING OR CONTAMINATING WATER.

Md Ann Code art 27 sec 451 (1957).

Descriptors: *Maryland, *Poisons, *Water pol tion sources, Legislation, Bodies of water, Potal water, Hazards, Public health, Bacteria, Wa supply, Water pollution, Water pollution contr Regulation, Water quality.

ntifiers: Penalties (Criminal).

ery person who knowingly and willfully poisons, iles or in any way corrupts or contaminates the ers of any body of water or source of water ply usable for drinking or domestic purposes by ans of disease germs, bacteria, or any other sonous matter shall be quilty of a felony and ject to not more than 20 years imprisonment. nilds-Fla)
9-09803

ATER POLLUTION CONTROL COMPACT.

Stat Ann tit 10, secs 1051-1053 (1958), as ended, (Supp 1968).

scriptors: *Vermont, *Interstate compacts, ater pollution control, *New England Interstate PS Compact, Interstate commissions, Water pol-on, Legislation, Interstate rivers, New England, w York, Compacts, Water law, Bodies of water, gal aspects, Appropriation, Cost sharing.

e governor is authorized and directed to execute ompact, as set forth in sections 991-1002 of this e, with any of the New England states or with w York. Within 30 days after execution, he shall oint 3 persons to serve as commissioners to the w England Interstate Water Pollution Control mmission. The commissioner of water resources l the commissioner of health shall serve as ex of-o members thereon. The commissioners shall e the powers and duties as set forth in the com-ct. Funds are appropriated for the purposes of Commission. (Helwig-Fla)
9-09804

ATER POLLUTION CONTROL COMPACT.
l Rev Stat Ann secs 488:1 thru 488:5 (1968).

scriptors: *Water pollution, *Interstate com-cts, *Water pollution control, *New Hampshire, nnecticut, Maine, Massachusetts, Rhode Island, rmont, Legislation, Regulation, State govern-nts, State jurisdiction, Public benefit, Adminis-tive agencies, Legal aspects, Water policy, ter quality control, New England Interstate PS Compact, New England, Interstate commis-ns.

e Water Supply and Pollution Control Commis-n is authorized to enter into the New England In-state Water Pollution Control Compact with any e or more of the states of Maine, Vermont, ode Island, Connecticut, New York, Mas-husetts. This compact concerns the abatement existing pollution and the control of future pollu-n in the interstate waters of New England. The tes of Connecticut, Maine, Massachusetts, New mpshire, Rhode Island, and Vermont agree that provisions of the compact shall apply to eams, ponds, and lakes which are contiguous to o or more signatory states, which flow through o or more signatory states, or which have a tribu-y contiguous to two or more signatory states, l such provisions shall also apply to tidal waters bing and flowing past the boundaries of two tes. The New England Interstate Water Pollution ntrol Commission is established. The powers, ies, and jurisdiction of the Commission are enu-rated by the Compact. Procedures to be fol-ed in entering into the Compact are presented are the qualifications for the commissioners. oulder-Fla)
9-09806

ATER POLLUTION CONTROL COMPACT.
Rev Stat Ann secs 488:1 thru 488:1 (V)
68).

scriptors: *Interstate compacts, *Water pollu-n, *Water pollution control, *New Hampshire, w England, Vermont, Massachusetts, Maine, ode Island, Connecticut, New York, Legislation, gulation, Water law, State governments, Public efits, Public rights, Administrative agencies, Water policy, Public health, Interstate, Interstate commissions, New England Interstate WPS Compact.

The Water Supply and Pollution Control Commission is authorized to enter into a compact with any one or more of the New England states plus New York, under the provisions of the New England Interstate Water Pollution Control Compact. It is agreed between the signatory states that the provisions of the Compact shall apply to streams, ponds, and lakes which are contiguous to two or more signatory states, which flow through two or more signatory states, or which have a tributary contiguous to two or more signatory states, and such provisions shall also apply to tidal waters ebbing and flowing past the boundaries of two states. The Commission, a body corporate and politic, shall consist of five commissioners from each signatory state. These members shall represent the state health department, the state water pollution control board, municipal interests, industrial interests, and an agency acting for fisheries or conservation. For any action of the Commission to impose an obligation on member states, a majority of the members from each signatory state must vote in favor thereof. (Moulder-Fla)
W69-09807

WATER POLLUTION CONTROL COMPACT.
NH Rev Stat Ann secs 488:1 (d)-488:2 (1968).

Descriptors: *New Hampshire, *Water quality control, *Administrative agencies, *Water pollution control, Legislation, New England, Sewage, Waste treatment, Industrial waste, Water quality, Water pollution, State jurisdiction, Recreation, Waste disposal, Systematics, Shellfish, New England Interstate WPS Compact, Standards, Water policy, Interstate commissions.

No single standard of sewage and waste treatment is considered practical, and the degree of treatment of sewage in industrial wastes should take into account the classification of the receiving waters according to present and proposed highest use. The commission establishes reasonable physical, chemical, and bacteriological standards of water quality satisfactory for various classifications of use. Each signatory state pledges to provide for the abatement of existing pollution and for the control of future pollution of interstate inland and tidal waters; however, nothing in this compact should be construed to repeal or prevent the enactment of any legislation imposing any additional condition or restriction to further lessen the pollution of waters within each state's jurisdiction. The signatory states also agree to appropriate for expenses such sums as shall be recommended by the commission, and each state with the exception of New York shall set limits on the amounts to be obligated. The compact is effective immediately upon adoption by any two contiguous states of New England but only insofar as it applies to those states and upon approval by federal law. (Moulder-Fla)
W69-09808

WATER POLLUTION CONTROL COMPACT.
NH Rev Stat Ann secs 488:2 thru 488:5 (1962).

Descriptors: *Federal government, *State governments, *Administrative agencies, *New Hampshire, New England, Legislation, Administration, Legal aspects, Regulation, Water policy, Interstate, Interstate commissions.

Whenever the State Water Supply and Pollution Control Commission enters into a compact with the duly authorized agency of any of the New England states and New York, it shall file a certified copy in the office of the secretary of state and shall notify the governor of its action. Such compact shall thereupon become effective and operative as between New Hampshire and such other state or states, subject to the consent of the Congress of the United States. After the compact becomes effective, the governor shall appoint five persons to serve as commissioners to the New England Interstate Water Pollution Control Commission. One of the commissioners must be an employee of the State Water Supply and Pollution Control Commission, and the other four shall be appointed from the membership of the New Hampshire Water Supply and Pollution Control Commission. (Moulder-Fla)
W69-09809

PUBLIC HEALTH (DRAINAGE, PUBLIC POOLS AND BATHING PLACES).
NH Rev Stat Ann sec 147:14 (1964), as amended, (Supp 1967).

Descriptors: *New Hampshire, *Regulation, *Drainage, Legislation, Cesspools, Septic tanks, Recreation facilities, Drainage practices, Drainage programs, Controlled drainage, Drainage systems, Drainage water, Drainage engineering.
Identifiers: Penalties (Civil).

No person shall deposit any drainage from a privy, toilet, cesspool or septic tank within the limits of any public highway if such discharge enters or passes through any open highway ditch. All violations are to be reported to the state or local health authorities. A penalty, after notice, of not more than ten dollars a day is provided. (Moulder-Fla)
W69-09812

SANITARY WATER BOARD.

Ill Ann Stat ch 19, secs 145.1-145.18 (Smith-Hurd 1963), as amended, (Supp 1969).

Descriptors: *Water pollution, *Pollution abatement, *Illinois, *Waste disposal, Municipal wastes, Domestic wastes, Industrial wastes, Wastes, Sewage, Sewage disposal, Pollutants, Water pollution sources, Water pollution control, Permits, Legal aspects, Legislation, State governments, Standards, Water quality control, Administrative agencies, Regulation, Planning.
Identifiers: Injunctions (Prohibitory).

For public protection the state will maintain standards of purity in its waters consistent with their use for domestic and industrial water supplies and will regulate discharge of wastes. The statute creates the Sanitary Water Board to carry out the purposes of the act. The Board determines if pollution exists in any given body of water and is empowered to require discontinuance of pollution through its own orders or through court action. The board may issue or withhold permits to discharge wastes or sewage, may require submission of plans and specifications for new sewage works, and may develop a comprehensive plan of pollution control. The statute outlines procedure for enforcement of board orders. Draining or dumping pollutants into the waters of the state is expressly prohibited unless a permit is properly secured. Permits are also required for increasing amounts of pollutant drainage. Fines are imposed for violations, and injunctive relief is available through action by the attorney general. The act is not designed to alter acts pertaining to oil, gas, and coal resources, nor does it interfere with existing sanitary district operations. (Kelly-Fla)
W69-09822

OHIO RIVER VALLEY WATER SANITATION.

Ill Ann Stat ch 111 1/2 secs 117-121 (Smith-Hurd 1966).

Descriptors: *Illinois, *Water pollution control, *Interstate commissions, *Interstate compacts, Environmental sanitation, United States, Indiana, Kentucky, New York, Ohio, Pennsylvania, Tennessee, West Virginia, Virginia, Legislation, Ohio River, Interstate rivers, Water quality control, Industrial wastes, Sewage.

The Ohio River Valley Water Sanitation Compact between Illinois, Indiana, Kentucky, New York,

Ohio, Pennsylvania, Tennessee, and West Virginia is enacted into law. The compact provides that the signatory states from a common agency to control pollution of the Ohio River basin by creating a sanitation district which includes any water flowing into the Ohio River. The Ohio River Valley Water Sanitation Commission is provided for and is composed of three members from each member state and three from the United States government. The purpose of the compact is to keep pollution from sewage or industrial waste from harming interstate waters and public health. The Commission is empowered to make rules for regulation and sanitation, to study and report upon the pollution problems, and to make recommendations to the various states, communities and corporations with regard to such improvements. The Commission, after notice and hearing, may issue orders to those violators of these rules, and such orders are enforceable in any United States district court located in any signatory state. (Darragh-Fla)
W69-09836

WATER AND AIR POLLUTION CONTROL.
Ark Stat Ann secs 82-1901 thru 82-1903 (Supp 1967).

Descriptors: *Arkansas, *Air pollution, *Water pollution control, *Administrative agencies, Water pollution, Legislation, Sewage, Sewers, Treatment facilities, Discharge (Water), Industrial wastes, Environmental sanitation.

For purposes of this act sewage, industrial waste, pollution, sewer system, treatment works, disposal system, waters of the state, and discharge into the waters of the state are defined. The Arkansas Pollution Control Commission is created and is authorized to call upon and receive the assistance of any state educational institution, experiment station, or any state agency, and to require the furnishing of any reasonable assistance deemed necessary or beneficial to the Commission in carrying out the provisions of this act. (Marsee-Fla)
W69-09844

WATER AND AIR POLLUTION CONTROL.
Ark Stat Ann secs 82-1904 thru 82-1909 (Supp 1967).

Descriptors: *Arkansas, *Water pollution control, *Administrative agencies, *Water quality control, Legislation, Sewage, Sewage disposal, Wastes, Waste disposal, Disposal, Permits, Abatement, Impaired water quality, Pollution abatement, Treatment facilities, Water conservation, Standards, Planning, Regulation, Interstate.

The Arkansas Pollution Control Commission is charged with the following powers and duties: (1) to administer and enforce all laws and regulations relating to water pollution; (2) to conduct investigations and surveys and to classify state waters; (3) to establish water quality and pollution standards; (4) to prepare a comprehensive program for water pollution elimination or reduction; (5) to regulate the discharge of sewage or waste and control the issuance of permits therefor; (6) to regulate the construction and modification of disposal systems; (7) to conduct investigations and hearings; (8) to act as the State Water Pollution Agency for purposes of the Federal Water Pollution Control Act; (9) to require information from persons operating disposal systems, to enter property and to examine books and records; (10) to cooperate with other state and federal agencies; (11) to accept money and property; and (12) to enter into agreements with other states. Any action causing, or likely to cause, pollution is declared a public nuisance. A permit is necessary: to discharge sewage or waste into state waters; to establish facilities, outlets or disposal systems therefore; or to increase any sewage or waste. (Marsee-Fla)
W69-09845

SEWAGE DISPOSAL.
Ill Ann Stat ch 42, secs 306, 306.1, 306.2, 306.3, 307 (Smith-Hurd Supp 1969).

Descriptors: *Illinois, *Sewage disposal, *Sewage treatment, *Drainage, Administrative agencies, Legislation, Legal aspects, Water law, Water policy, Sewage districts, Sewage treatment, Governments, Local governments, Administration, Regulation, Financing, Water pollution control, Water purification, Public health, Water quality control, Condemnation, Operation and maintenance, Assessments, Construction, Industrial wastes.

Sewage disposal (including industrial sewage) is the responsibility of the board of trustees of all sanitary districts. These districts must attempt to preserve their water supply from contamination. For this purpose they may construct necessary enclosed conduits and pipes. The board is also responsible for drainage within the district and must supply necessary drains, ditches, channels and outlets for this purpose. Treatment and purification of sewage when same shall flow into any lake or watercourse falls within the board's spectrum of duties. When disposal of industrial wastes cause an increased economic burden the board may levy an assessment against the producer thereof to pay the excess costs. The district is responsible for the various aspects related to operation of a sewage system including: acquisition and maintenance; coordination and control of interconnections with tributary sewer systems; and fees for inspection prior to connection with the system. The district acquires property by purchase, condemnation or otherwise as required for its corporate purposes. Compensation to landowners for such property may be in gross sum or in annual rental payments. (Johnson-Fla)
W69-09877

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

THE LINEAR DECISION RULE IN RESERVOIR MANAGEMENT AND DESIGN. I. DEVELOPMENT OF THE STOCHASTIC M ODEL,
Johns Hopkins Univ., Baltimore, Md.; and Geological Survey, Washington, D.C.
Charles Revelle, Erhard Joeres, and William Kirby.
Water Resources Res, Vol 5, No 4, p 767-777, Aug 1969. 11 p, 2 tab, 9 ref.

Descriptors: *Reservoir design, *Reservoir operation, *Water management (Applied), *Optimization, *Systems analysis, Stochastic processes, Model studies, Statistical models, Linear programming, Markov processes, Dynamic programming, Decision making.
Identifiers: Reservoir operation models, Stochastic models.

With the aid of a linear decision rule, reservoir management and design problems often can be formulated as easily solved linear programming problems. The linear decision rule specifies the release during any period of reservoir operation as the difference between the storage at the beginning of the period and a decision parameter for the period. The decision parameters for the entire study horizon are determined by solving the linear programming problem. Problems may be formulated in either the deterministic or the stochastic environment. (Knapp-USGS)
W69-09459

ON THE RANDOM OCCURRENCE OF MAJOR FLOODS,
Geological Survey, Arlington, Va.
William Kirby.
Water Resources Res, Vol 5, No 4, p 778-784, Aug 1969. 7 p, 4 fig, 6 ref.

Descriptors: *Flood forecasting, *Statisti methods, *Probability, Model studies, Statisti models, Hydrograph analysis, Rainfall-runoff re tionships.
Identifiers: Poisson flood forecasting mod Recurrence intervals.

Plausible hydrologic arguments imply that flo can be represented as the successes or exceedan in a sequence of randomly spaced Bernaulli tri representing the occurrence of hydrograph pea This representation generalizes existing flood currence models by admitting an arbitrary pro bility distribution of the times between trials and arbitrary criterion for distinguishing betwe floods and ordinary hydrograph peaks. Analysis this model shows that at sufficiently small ceedance probabilities the probability distributio and moments of the interexceedance time, waiting time to the next exceedance, and number of exceedances approach those implied the occurrence of trials in a Poisson process. T theory therefore constitutes a rational justificati of Poisson models of flood occurrence as well a rational explanation of empiric observations. (napp-USGS)
W69-09460

A NOTE ON MORAN'S PROBABILI THEORY OF DAMS AND STORAGE SYSTEM
City Univ., London (England).
For primary bibliographic entry see Field 04A.
W69-09470

OPTIMIZATION OF A CLASS OF RIV AERATION PROBLEMS BY THE USE OF MU TIVARIABLE DISTRIBUTED PARAMET CONTROL THEORY,
Rutgers - The State Univ., New Brunswick, N Water Resources Research Inst.
V. J. Tarassov, H. J. Perlis, and B. Davidson.
Water Resources Research, Vol 5, No 3, p 5 573, Jun 1969. 11 p, 2 tab, 9 fig, 18 ref. OW Project A-017-NJ.

Descriptors: *Optimization, *Control thec *Mathematical studies, Optimum developm plans, Water pollution.
Identifiers: *Distributed parameter, *Cont theory, Multivariable control theory, Measurem policy.

Multivariable distributed parameter control the has been applied to the optimization of artificial stream aeration of polluted rivers. The optimi tion was developed for a general integral type cost functional with weighted energy constrai Three specific types of aeration control poli were considered: distributed space and time c trol, distributed time control and distributed sp control. Employing typical hydrologic coefficie with the transient version of Streeter-Phelps eq tion, the optimal aeration control surfaces obtai were all found to lie well within the operat characteristics of commercial aeration equipm Distributed parameter control theory applied water pollution systems proved to be a powe mathematical programming method comparabl linear and dynamic programming. (Whipple-R gers)
W69-09558

ENGINEERING APPLICATION OF M TIVARIABLE DISTRIBUTED PARAMET CONTROL THEORY,
Rutgers - The State Univ., New Brunswick, N Water Resources Research Inst.
H. J. Perlis, and Burton Davidson.
Technical Research Project Completion and mination Report, College of Engineering, Rutge The State University of New Jersey, Sept 1969. 6 ref. OWRR Project A-017-NJ.

Descriptors: Water pollution, *Optimizati Planning, *Mathematical studies, Aeration.

entifiers: Distributed parameter, *Control eory, Measurement policy, Multivariable control eory, Optimum development plans.

ultivariable distributed parameter control theory as been applied to the optimization of artificial in-eam aeration of polluted rivers. The optimiza-on was developed for a general integral type of st functional with weighted energy constraints. hree specific types of aeration control policies ere considered: distributed space and time con-ol, distributed time control, and distributed space ntrol. Employing typical hydrological coeffi-ents with the transient version of Streeter-Phelps uation, the optimal aeration control surfaces ob-ined were all found to lie well within the operat-g characteristics of commercial aeration equip-ent. Distributed parameter control theory applied water pollution systems proved to be a powerful athematical programming method comparable to ear and dynamic programming. As an adjunct to e distributed parameter optimization part of the search, an investigation of the optimal measure-ent policy for distributed parameter systems was ndertaken. Using the transient version of the reeter-Phelps equations, a measurement policy as formulated to minimize the integral of the ean-square value of the error resulting from the fference between the nominal dissolved oxygen nd actual dissolved oxygen profiles subject to easurement cost constraints. (Whipple-Rutgers) 69-09559

OLE OF STATE GOVERNMENTS IN U. S. ATER MANAGEMENT,
or primary bibliographic entry see Field 06E.
69-09581

N OBJECTIVE APPROACH TO DE FINITIONS ND INVESTIGATIONS OF CONTINENTAL YDROLOGIC DROUGHTS,
olorado State Univ., Fort Collins. Dept. of Civil ngineering.
or primary bibliographic entry see Field 02E.
69-09704

HE WATER RESOURCES AND WATER ESOURCES PLANNING IN GEORGIA,
eorgia Univ., Athens. Dept. of Agricultural conomics.
onald M. North.
ational Science Foundation Summer Short ourse on Water Resources, New Mexico State niversity, Las Cruces, N Mex, June 1969. 37 p, 4 g, 11 ref. OWRR Proj B-011-GA.

escriptors: *Water resources, *Resource anning, *Long-term planning, *Water resources evelopment, *Georgia, Economics, Social needs, ater quality, Decision making, Methodology, roject planning, River Basin development.

history of Georgia's water resources is presented om Colonial times to the present including a scussion of the social and economic aspects of e water resources development. Water resources es and problems are discussed. The need for a ate water plan and the development of a cogni-ve planning process to prevent oversight of cer-in water resources planning needs is discussed. A mmary of water resources development and use Georgia is presented. The planning objectives, e planning process, planning strategies, and anning tactics for planning, using, and conserving eorgia's natural human and capital resources are esented together with a synoptic outline for in-ntories of the resources. The paper contains a mmary and has 11 bibliographical references. Conway-Ga Inst of Tech) 69-09728

TOCHASTIC PROGRAMMING: A SURVEY,
isconsin Univ., Madison.
harles E. McQuillam.
niv of Wisconsin, Water Resources Center, echnical, Report, Mar 1969. 65 p.

Descriptors: *Stochastic processes, *Optimization, Computers, Computer programming.
Identifiers: Probabilistic programming, Vector optimization, Optimum value, Programs with recourse, Chance constrained programs.

This work provides an organization and summary of the major results in the field of stochastic (or probabilistic) programming. Mathematical derivations and proofs are largely omitted both for lack of space and because they are unnecessary. The purpose of this work is to give an overview of the field and references for those who wish to investigate further. Initially, a very general problem of programming under uncertainty is defined. Next, various ways of interpreting this problem and the resulting methods of handling its uncertainty are discussed. The bulk of the paper is devoted to those interpretations which appear to have received the most attention in the literature: vector optimization, the distribution of the optimum value, programs with recourse, and chance constrained programs. Finally, a few special topics are considered.
W69-09772

6B. Evaluation Process

AN ASSESSMENT OF THE NATION'S WATER RESOURCES,
Water Resources Council, Washington, D.C.
Bruce Blanchard.
'The Nation's Water Resources' is available from Superintendent of Documents, Government Printing Office, Washington, DC. 20242. J Water Pollut Contr Federation, Vol 41, No 8, Part 1, p 1407-1420, Aug 1969. 14 p, 11 fig, 4 tab.

Descriptors: *Reviews, *Water resources, *United States, Water Resources Planning Act, Water supply, Water levels, Streamflow, Water utilization, Waste water treatment.
Identifiers: First National Water Resources Assessment.

Some of the technical information contained in the Water Resources Council's First National Assessment is reviewed. Comments cover background information on the Water Resources Planning Act, the long-run plans for the National Assessment, and illustrations of variations in the water situation in the Ohio, Missouri, Rio Grande, and Columbia-North Pacific regions. The National Assessment was published in November 1968. (Knapp-USGS)
W69-09452

PUMPED STORAGE--THE HANDMAIDEN OF NUCLEAR POWER,
Northeast Utilities Service Co., Hartford, Conn.
Sherman R. Knapp.
Inst Elec Electron Eng Spectrum, Vol 6, No 4, p 46-52, Apr 1969. 7 p, 3 fig, 2 tab, 1 ref.

Descriptors: *Pumped storage, *Nuclear power-plants, *Hydroelectric power, Costs, Economics, *Peaking capacities, Benefits, Recreation, Peak loads, Cost comparisons, Electric power production, Electric power, Electric power costs, Electric power demand, Powerplants.
Identifiers: *Nuclear power, Fossil fuels, *Northfield Mountain Proj (Mass), Base loads, Spinning reserve.

Construction of pumped-storage hydro plants, favored by area topography, will offset the relatively high fixed costs of nuclear plants by maximizing the capacity-use factor of nuclear facilities and minimizing the total cost per unit of energy output. This combination provides efficient base load, economical peaking capacity, effective spinning reserve, and many recreational and other social benefits. Power companies in the New England states, where fossil-fuel cost is high, have determined that low-variable-cost nuclear generation is desirable for this region. The 1000-mw pumped-storage Northfield Mountain Project in Massachusetts, used for peaking and reserve standby in the New England power systems, is reviewed, giving specific references to economies and social benefits derived from the project. Cost comparisons of base-load nuclear units in combination with gas turbine, steam peaking, and pumped hydro plants are given for the 1973 and 1977 predicted large-area loads in the New England states. (USBR)
W69-09551

ORGANIZATIONAL ALTERNATIVES FOR RECREATIONAL RESOURCE MANAGEMENT: AN ANALYSIS OF STATE AGENCIES,
Michael F. Brewer, and Betty Bordner.
Natural Resources Journal, Vol 6, No 4, p 560-579, Oct 1966. 20 p, 13 ref.

Descriptors: *Administrative agencies, Inter-agency cooperation, Political aspects, Planning, Economic efficiency.
Identifiers: *Recreational resource management, State agencies, Scope of jurisdiction, Objectives, Interest groups.

The purpose of this study is to identify the specific activities entailed in recreational resource management; to determine the particular organizational arrangements for these activities; and to evaluate typical state organizations employed for these purposes. Consideration was also given to those public recreational resources for which responsibility is divided among a number of organizations. First, the structures of recreational agencies sharing responsibility in particular states were identified, classified, and evaluated in terms of the way they perceive the objectives of recreational resource management and in terms of their scope of jurisdiction. Second, the influence of this organizational structure upon a constituent agency was assessed using criteria generally consistent with the welfare-economics notion of efficiency. Results indicate that the greatest advantage of single-resource agencies is their ease of access to interest groups. However, their limitations with respect to a broad planning scope, a wide range of technical competence, and common analytical practices severely limit their advantage of access, especially in planning. Unified agencies are strong in planning scope, technical competence, and uniform analytical procedures. They also have potential for establishing communication to interest groups. (Gossen-Chicago)
W69-09561

POLLUTION AND ENVIRONMENTAL QUALITY,
Resources for the Future, Inc., Washington, D.C.
For primary bibliographic entry see Field 05G.
W69-09563

ECONOMIC FRAMEWORK FOR SALINITY CONTROL PROJECTS,
For primary bibliographic entry see Field 05G.
W69-09565

REPORT ON OHIO RIVER RECREATION FACILITY, CITY OF PORTSMOUTH AND SCIOTO COUNTY, OHIO.
Stanley Engineering, Cleveland, Ohio.

Stanley Engineering Company, Muscatine, Iowa, 1963. 38 p, 16 fig, 8 tab, 18 ref, 2 append. Area Redevelopment Admin., Washington, DC.

Descriptors: *Marinas, *Planning, *Recreation facilities, *Economic impact, Boating, Access routes, Tourism, Water utilization, Benefit-cost analysis.
Identifiers: *Portsmouth (Ohio), *Scioto County (Ohio).

Scioto County and Portsmouth, Ohio have experienced a depressed economy as a result of changes in industry. These areas desire to improve their economic conditions through planning. One possibility is the creation of a marina and related recreation facilities near Portsmouth, Scioto Coun-

ty, Ohio. Analysis of the population and boat use in the geographic area that such a marina would draw from shows adequate demand to justify installation on the Ohio River of a marina-recreation facility having berths and year-around storage for approximately 100 boats. Also included in the project would be facilities for servicing and launching boats; an Operations Building; Sales, Service, and Administration Building; Snack Bar and Restaurant; and Parking Area. Five possible site locations are analyzed in relation to topography, river characteristics, accessibility, and relation to cultural features. The feasibility of the project is analyzed by developing the annual benefit and costs of the proposed project. The proposed project is found to be economically feasible and would have demonstratable economic impact on the area. It is recommended that the project be implemented by public agency construction of the project with lease of the facilities to a private business venture for operation and maintenance. (Marriott-Chicago)
W69-09568

HYDROLOGIC RESEARCH FOR WATERSHED ENGINEERING,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
For primary bibliographic entry see Field 04D.
W69-09669

GROUNDWATER APPRAISAL OF THE LITTLE WABASH BASIN ABOVE THE GAGE BELOW CLAY CITY AND THE LOUISVILLE RESERVOIR SITE, ILLINOIS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W69-09693

GROUNDWATER APPRASIAL OF THE SKILLET FORK BASIN ABOVE WAYNE CITY AND HELM RESERVOIR SITE, ILLINOIS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W69-09694

GROUNDWATER APPRAISAL OF THE BIG WALNUT CREEK BASIN ABOVE LITTLE WALNUT CREEK AND BIG WALNUT CREEK RESERVOIR SITE, INDIANA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W69-09695

GROUNDWATER APPRAISAL OF THE BIG BLUE RIVER BASIN AND BIG BLUE RESERVOIR SITE, INDIANA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W69-09696

GROUNDWATER APPRAISAL OF THE FLATROCK RIVER BASIN AND DOWNEYVILLE RESERVOIR SITE, INDIANA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W69-09697

THE MILWAUKEE RIVER,
Milwaukee River Technical Study Committee, Wis.
Harry C. Brockel.
Milwaukee River Tech Study Comm Rep, 1968. 163 p, 5 fig, 5 map, 43 photo, 11 tab, 62 ref.

Descriptors: *Rivers, *Urbanization, *Multiple-purpose projects, *Recreation, *Wisconsin, Navigation, Aesthetics, Parks, Recreation facilities, Landscaping, Land use, Scenery, Water quality, Water pollution, Water pollution control, Planning.
Identifiers: Milwaukee River, Milwaukee.

The problems of the Milwaukee River, Wisconsin were inventoried and recommendations are listed for improvement of the river for aesthetic and recreational uses for the city of Milwaukee. The present quality of the river water and banks are surveyed and compared with past conditions as well as present conditions of rivers in other cities. It is concluded that the Milwaukee River can be a great asset to Milwaukee with a reasonable expenditure of time, money, and effort. The present blighted condition of the river banks in the downtown area should actually help in land acquisition for restoration, because it has depressed land prices. San Antonio, Texas is used as an example of what a city can do in restoring a river for public emjoyment. (Knapp-USGS)
W69-09703

THE IDENTIFICATION AND CRITICAL ANALYSIS OF SELECTED LITERATURE DEALING WITH THE RECREATIONAL ASPECTS OF WATER RESOURCES USE, PLANNING, AND DEVELOPMENT,
Illinois Univ., Urbana. Water Resources Center.
For primary bibliographic entry see Field 10.
W69-09719

HUMBOLDT RIVER STUDIES,
Nevada Univ., Reno. Desert Research Inst.
For primary bibliographic entry see Field 04B.
W69-09724

A PLAN FOR A COMPREHENSIVE WATER RESOURCES RESEARCH INFORMATION EXCHANGE SYSTEM,
Leeds, Hill and Jewett, Inc., San Francisco, Calif.
For primary bibliographic entry see Field 10.
W69-09737

TOWARD A NATIONAL WATER PLAN,
Lewis Gordy Smith.
Pap, Irrig Age, 1969. 23 p, 18 fig.

Descriptors: *Planning, Water reuse, Import, Natural resources, *Water resources development, *Water collection system, Water, Pumping plants, Water conveyance, Population growth, Preliminary investigations, Canals, Water requirements, Cloud seeding, Demineralization, Reservoirs, *Water distribution (Applied), Tunnels, Dams, Siphons, Inter-basin transfers.
Identifiers: *Water plans, Canada, *Western United States, International cooperation.

Water is the one limiting basic resource having the most influence on the comforts of an expanding population of this nation. The greatest challenge to the Western United States is a need to overcome the persistent lack of water. A concept of a water collection and distribution system using northern Canadian water to provide water for the Prairie Provinces of Canada and the 17 Western States of the U S is discussed. The elements of a comprehensive water augmentation system for the Great Lakes region are outlined. Because of the recognized importance of this single unique commodity, water augmentation merits a new, higher priority among our national policies for the economic justification of large water augmentation projects and t hose affecting whole segments of the nation, and, thereby, the entire nation. Implementing such a water plan requires much time; planning must start many years before the actual need exists. (USBR)
W69-09766

PLAN AND PROGRAM FOR THE BRANDYWINE,
Pennsyl vania Univ., Philadelphia. Inst. for Environmental Studies.
Robert J. Coughlin, John C. Keene, Benjamin H. Stevens, and Ann Louise Strong.
Pennsylvania Univ, Inst for Environmental Studies, Oct 1968. 228 p.

Descriptors: *Urbanization, *Drainage syste
*Land use, Storm runoff, *Water resour
development, Land tenure, Real propert, Legis
tion..
Identifiers: Brandywine, Chester Co (Penn
*Conservation easements.

The Plan is a proposal for the wise use of the wa
and land resources of the Upper East Branch
Brandywine Creek, Chester Co., Pa. The Plan w
developed for the Chester Co. Water Resour
Authority by the Institute for Environmental St
dies, University of Penna; Regional Scien
Research Inst.; United States Geological Surv
and their consultants. The aim of the Plan is
prevent deterioration of the water resources a
thus to retain the amenities of related land when
banization occurs in the Brandywine watersh
The Plan recommends 3 types of action: pub
purchase of conservation easements or other le
than fee interests on floodplains, stream and swa
buffers, steep slopes and forests; development a
adoption of detailed water supply and sewa
disposal plans in advance of urbanization; a
enactment of strong local regulations for erosi
and storm runoff control.
W69-09768

**STRATEGIC CONSIDERATIONS IN ATTAI
ING WATER RESOURCES PLANNING GOAL**
Wisconsin Univ., Madison.
I. K. Fox.
Journal Water Pollution Control Federation, Ju
1969, Vol 41, No 7, p 1368-1376. 9 p, 5 ref.

Descriptors: *Administrative agencies, Wa
resources development.
Identifiers: *Conservation agencies, Decision ma
ing processes, Public planning, Strategies.

This paper suggests how planning fits into decisio
making in a democratic system, how it contribut
to the effectiveness of the system, and what stra
gies planning entities should use to maximize effe
tiveness. Since people have differing val
preferences, not all people will favor the sa
plans. The function of public planning is to ident
and evaluate alternative courses of action so as
aid individuals and organizations in deciding wh
course of action they favor. Since the objective is
secure a complete airing of differing objectives a
potential programs, the various interests shou
have the opportunity to marshall and present pr
grams which they support. These concepts sugg
different strategies for different agencies and
ganizations. The Executive Office of the Preside
as an agency that seeks to represent the nation a
whole, should foster the presentation of competi
plans so that it can make a more intelligent choi
among the alternatives. The federal water develo
ment agencies should present alternative plans
public consideration, if the danger of stalema
among competing interests is to be avoided. T
state agencies should pursue a planning role ind
pendent of the federal agencies until alternati
have been assessed and the state interest det
mined. The conservation agencies should be staff
to prepare and support plans that best serve th
own interests. And the private interest grou
should not only criticize and support the plans
others, but should also be staffed to prepare a
support plans that best serve their interests. T
framework would enrich the supply of informati
about alternative plans and thus improve decisio
making processes.
W69-09771

**CONSTITUTIONAL ISSUES IN GAS AND O
AN ANALOGY,**
For primary bibliographic entry see Field 06E.
W69-09793

CONCLUSIONS AND RECOMMENDATIONS,
Minnesota Univ., Minneapolis. Water Resour
Research Center.
For primary bibliographic entry see Field 06E.
W69-09800

)WA NATURAL RESOURCES COUNCIL.

owa Code Ann secs 455A.1 to 455A.39 (Supp 969).

escriptors: *Iowa, *Flood control, *Water sources, *Water control, Flood plains, Diversion, lood plain zoning, Legislation, Flood protection, torage, Encroachment, Permits, Withdrawal, Vater resources development, Water management Applied), Floodways, Surface waters, Groundater, Beneficial use, Wastes, Watercourses Legal), Basins, Impounded waters, Average flow, dministrative agencies, Regulation.

ecognizing the importance of flood control and he orderly development, wide use, protection and onservation of the state's water resources, the owa Natural Resources Council is created and has he following functions and duties: (1) to establish nd enforce a comprensive state-wide program for he control, utilization and protection of the state's rface and groundwater resources; (2) to coorinate state planning with local and national lanning; (3) to enter into negotiations and agreeents with the federal government relative to ederally authorized or constructed projects; (4) to onstruct flood works; (5) to coordinate the esign, construction, and operation of all flood ontrol works; (6) to control the issuance of perits to divert, store, or withdraw waters and to inestigate the potential effects of such uses; and (7) o establish and enforce regulations for the evelopment and use of the flood plains of the tate's rivers and streams, including encroachment mits, protection methods, and minimum protecon levels. For purposes of this act flood plains, loodway, surface water, groundwater, diffused vaters, depleting use, beneficial use, regulated use, onregulated use, waste, watercourse, basin, stablished average minimum flow, and impounded vater are defined. (Marsee-Fla)
V69-09828

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

CONVENTION AND LIMITATION IN BENEFIT-COST ANALYSIS,
Richard J. Hammond.
Natural Resources Journal, Vol 6, No 2, p 195-222, Apr 1966. 28 p, 28 ref.

Descriptors: *Cost-benefit analysis, Decision-making, History, Optimization, Return (Monetary), Cost-benefit ratio, Legislation.
Identifiers: *Green Book, Informed common sense, Opportunity costs, Benefit minus cost.

The article addresses itself to two questions: (1) How, and how far, is it possible to secure uniformity of practice between different agencies using benefit-cost analysis. (2) At what point does a further increment of speculation promise less than a commensurate increase in the accuracy of the forecast. A history is given of the rise of benefit-cost analysis to its exalted position of authority in resource questions. Development of the Green Book is described. The most influential and persistent error in the Green Book stems from the fallacy of maximizing net returns. By failing to consider the differences in opportunity costs, the prescribed method of analysis often fails to seek the maximum return on capital. Inclusion of opportunity costs reinstates the use of benefit-cost ratios over benefit minus cost. The article emphasizes that a prescriptive rule of behavior is not applicable to every case without qualification. Congress is not absolved of its final responsibility of decision by calculations which seem, falsely, to have dispensed with uncertainty. The range of error in benefit-cost analysis prohibits calling it 'accurate'; it is a measure of putative performance and no more. (Gossen-Chicago)
W69-09560

THE FINANCING OF SMALL MUNICIPAL WATER SYSTEMS IN GEORGIA,
Georgia Univ., Athens. Dept. of Agricultural Economics.
Howard Waldas.
MS Thesis, Univ of Georgia, Athens, Ga, Aug 1968. 218 p, 7 fig, 19 tab, 31 ref, 1 append. OWRR Proj B-011-GA.

Descriptors: *Municipal water, *Water rates, *Water costs, *Interest rate, *Financing, *Georgia, Cost repayment (Ability), Water values, Elasticity of demand, Government finance, Public utilities.

Objectives of the research were (1) to determine what methods of financing water systems are available to smaller municipalities, (2) to select and analyze the various factors that affect the abilit y of municipalities to obtain financing for developing their water systems, and (3) to indicate the future of financing of municipal water systems by the projection of current trends. Data on municipal interest rates and repayment abilities together with other pertinent information were obtained by personal survey of a randomly selected ten percent of Georgia's smaller municipalities. Officials of 49 municipalities with populations under 10,000 were interviewed. Three major sources of funds for municipal water systems are analyzed: (1) Water revenues from special assessments, user charges, fire protection fees, connection fees, and ad valorem taxes, (2) municipal securities composed of general obligation, special assessment, and revenue bonds, and (3) Federal loans and grants from the Farmer's Home Administration, the Economic Development Administration, and the Soil Conservation Service. Factors that affect the interest rate and the repayment ability of a municipality have been isolated and their significance measured. Models were designed from measured variables to permit a small Georgia city to compute the interest rate and repayment ability that could be expected from their financial status. Use of the models by smaller, unrated municipalities will enable them to have their financial position considered objectively by potential investors. Projections indicate that 56.7 percent of water systems financed by the cities sampled will be through Federal grants and loans. The trend toward Federal funds for financing small municipal water systems will continue as long as Federal programs offer lower interest rates. (Conway-Ga Inst of Tech)
W69-09730

ECONOMIC INCENTIVES AND WATER QUALITY MANAGEMENT PROGRAMS,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 05G.
W69-09769

FEDERAL FLOOD CONTROL COORDINATION.
For primary bibliographic entry see Field 04A.
W69-09829

6D. Water Demand

THE IDENTIFICATION AND CRITICAL ANALYSIS OF SELECTED LITERATURE DEALING WITH THE RECREATIONAL ASPECTS OF WATER RESOURCES USE, PLANNING, AND DEVELOPMENT,
Illinois Univ., Urbana. Water Resources Center.
For primary bibliographic entry see Field 10.
W69-09719

THE DEMAND AND PRICE STRUCTURES FOR WATER IN A HUMID AREA,
Georgia Univ., Athens. Dept. of Agricultural Economics.
Ronald M. North.
Department of Agricultural Economics, College of Agriculture, University of Georgia, Athens, Georgia, July 1969. 6 p, 10 ref. OWRR Project B-011-GA.

Descriptors: *Georgia, *Water costs, *Water rates, *Elasticity of demand, *Elasticity of supply, *Humid areas, Economics, Marginal productivity, Social values, Monetary returns, Southeast U.S., Municipal water systems, Water users.

The purpose of this study was to determine the price and income elasticities for water consumption in the humid Southeastern United States. Householders in 14 municipal water systems were interviewed for socio-economic characteristics and water consumption was correlated with these characteristics. In the Southeast the physical factors such as lawn area did not significantly affect household consumption of water. However, definite differences in consumption of water were found due to variations in prices of water and incomes or income surrogates such as value of the residence. Price elasticities were generally about -0.68 and income elasticities were generally about+0.80. Industrial consumption in poultry processing plants, textile finishing and pulp manufacturing varied considerably among plants in each industry according to gross use and use per unit of product. However, these variations appeared more closely related to such things as age of plant and management practices and not to the price of water nor to the value of marginal product produced by that water. (Conway-Ga Inst of Tech)
W69-09727

FACTORS INFLUENCING THE DEMAND FOR WATER IN POULTRY PROCESSING PLANTS,
Georgia Univ., Athens. Dept. of Agricultural Economics.
Donald L. Brewer.
MS Thesis, Univ of Georgia, Athens, Ga, June 1969. 94 p, 3 fig, 1 tab, 54 ref, 6 append. OWRR Proj B-0011-GA.

Descriptors: *Water demand, *Water costs, *Water values, *Marginal prices, *Southeast U.S., Wages, Georgia, Water users, Water reuse, Elasticity of demand, Industrial water.
Identifiers: Poultry industry, Poultry processing.

Objectives of the research were to determine the demand and factors influencing the quantity of water used in poultry processing plants and to determine the physical differences in the processing plants and how the differences affected water use. Data were collected by personal interview from randomly selected poultry processors located in a six-state area in Southeast U.S. From these data variables were selected to determine the influence on water usage by the processors. The production function was used also to derive the demand for water. Five independent variables were found that explained best the total amount of water withdrawn. These are the number of employees, the hourly wage rate, the marginal physical productivity of water, the marginal price of water, and the percent of water recycled. Water used per bird is explained by an equation with two independent variables, Federal inspection and the hourly wage rate. Three production functions were used in analyzing the data. These were the Cobb-Douglas equation, the quadratic equation and the square root equation. It was found that 88 percent of the variation was explained in the quadratic equation and in the square root equation. Various combinations of independent variables were used to explain the variations in total volume of water withdrawn and in the volume of water used per bird in selected poultry processing plants. The presence of Federal inspection and the hourly wage rate were important factors correlated with variations in water used per bird. Contrary to the original hypothesis, the price of water was of little value in explaining variations in water used in the processing plants. (Conway-Ga Inst of Tech)
W69-09729

6E. Water Law and Institutions

SANITARY AND DRAINAGE COMMISSIONS.
For primary bibliographic entry see Field 04A.
W69-09458

AID TO MUNICIPALITIES FOR WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W69-09523

MARINE TOILETS AND DISPOSAL OF SEWAGE FROM BOATS.
For primary bibliographic entry see Field 05G.
W69-09524

CONSERVATION: MINERALS IN SUBMERGED LANDS (LEASING OF STATE SUBMERGED LAND FOR MINING).

Del Code Ann tit 7, sec 6401-6440 (Supp 1966).

Descriptors: *Delaware, *Administrative agencies, *Leases, *Mining, Beds under water, Administrative decisions, Adjudication procedure, Legislation, Exploration, Exploitation, Oil, Natural gas, Sulfur, Permits, Surveys, Bids, Governors, Easements, Drilling, Negotiations, Royalties, Feasibility, Public rights, Regulation, Water pollution, State jurisdiction, Federal government, Insurance, Landfills, Rent, Shores, Seismic studies.
Identifiers: Delaware Water and Air Resources Commission.

The governor and the Water and Air Resources Commission are given the jurisdiction to lease state submerged lands for the purpose of mining oil, natural gas, sulphur, and other minerals. Definitions of terms used in the legislation are given. The Commission may grant permits for geological surveys of the submerged lands. The permittee is to follow regulations set out governing the permits. The Commission may examine the permittee's records but must keep them confidential. Before the Commission can lease lands it must hold a public hearing to determine the feasibility of the lease. The Commission must consider certain factors in deciding the feasibility of leasing. The lease gives exclusive drilling and mineral removal rights over a certain area. The lessee is to pay royalties and rents along with a performance bond. The Commission may permit different types of drilling and lease extensions. The lessee must protect against water pollution and upon termination of the lease may have to restore the property to its original condition. Certain schedules for drilling and production must be met. The Commission must consent to an assignment of the lease. The lessee may surrender the lease, or the state may cancel it upon certain circumstances. The Commission must follow certain bidding procedures. Successful bidders must comply with certain requirements before the execution of the lease. The Department of Defense must give prior approval to a lease. (Gadd-Fla)
W69-09537

CONSERVATION: MINERALS IN SUBMERGED LANDS (LEASING OF STATE SUBMERGED LAND FOR MINING).

Del Code Ann tit 7, sec 6401-6406 (Supp 1966).

Descriptors: *Delaware, *Administrative agencies, *Permits, *Beds under water, Leases, Exploration, Exploitation, Mining, Oil, Natural gas, Sulfur, Surveys, Administrative decisions, Shores, Adjudication procedure, Legislation, Regulation, Governors, Drilling, Seismic studies, State jurisdiction, Easements, Land, Subsurface investigations.
Identifiers: Delaware Water and Air Resources Commission.

The Governor and the Water and Air Resources Commission shall have jurisdiction to lease all submerged tide lands of this state. The leases are to be awarded for mineral exploration and exploitation. The Commission may not permit any interference, other than temporary interference, with the surface of the Atlantic shore. The Commission may, however, grant easements to portions of the surface of the Atlantic shore owned by the State to permit extraction of minerals. Lands administered by the Board of Game and Fish Commissioners cannot be leased by the Commission. Any person may apply to the Commission for a permit for making geological surveys on the tide and submerged lands of the state. The permit shall contain rules and regulations to protect natural resources. The permit will also limit the survey to specified lands. The permit is not exclusive and gives no preferential rights to any oil, gas, sulphur, or other mineral lease. A permit is not to exceed two years. The Commission may deny a permit on lands which would not be leased even if a lease were applied for. The Commission may require the permittee to make his survey records available to the Commission. Also the Commission may require as a condition to issuance of any lease that the lessee make available to the Commission all of his exploration records. The records from both the permittee and lessee are not to be disclosed. (Gadd-Fla)
W69-09541

CONSERVATION: MINERALS IN SUBMERGED LANDS (LEASING OF STATE SUBMERGED LAND FOR MINING).

Del Code Ann tit 7, sec 6407-6415 (Supp 1966).

Descriptors: *Delaware, *Administrative agencies, *Leases, *Beds under water, Bids, Feasibility, Public rights, Regulation, Drilling, Royalties, Rent, Administrative decisions, Legislation, Oil, Natural gas, Sulfur, Insurance, State jurisdiction, Water pollution, Shores, Land, Land tenure.
Identifiers: Delaware Water and Air Resources Commission.

The Water and Air Resources Commission shall hold a public hearing before lands are offered for leasing or upon an application for a lease. Notice of the hearing and the specific submerged lands under consideration is to be given to various state agencies, to the public, and to prospective applicants and bidders. The Commission may appoint an officer or employee to conduct the hearing. Any representative of the various state agencies served with notice of the hearing may question witnesses at the hearing. The Commission shall consider the feasibility of the lease considering the following factors: welfare of persons near the area of the lease; interference with recreational or residential areas; the esthetic and scenic value of the coast line; pollution; marine life; navigation; and drainage of minerals from state lands. A lease shall not be given for an area larger than six square miles. A lease shall grant the exclusive right to drill for and produce oil, gas, and other minerals. The lease extends for a primary term of ten years and for so long after the primary term as the lessee is producing or diligently attempting to produce. The Commission is to give a lease which requires at least 12 1/2% of gross production as a royalty. Also the Commission must specify a rent of at least $.25 an acre annually in the lease. The Commission may require insurance and performance bonds from the lessee as a condition to the lease. (Gadd-Fla)
W69-09547

CONSERVATION: MINERALS IN SUBMERGED LANDS (LEASING OF STATE SUBMERGED LAND FOR MINING).

Del Code Ann tit 7, sec 6415-6440 (Supp 1966).

Descriptors: *Delaware, *Administrative agencies, *Leases, *Beds under water, Bids, Well regulations, Administrative decisions, Drilling, Landfills, Offshore platforms, Negotiations, Water pollution, Permits, Oil, Natural gas, Sulfur, Governors, Regulation, Exploration, Federal Government, State jurisdiction, Permits, Land use, Land tenure.
Identifiers: Department of Defense.

A lessee may use slant drilling or adjacent drilling unless prohibited by the Water and Air Resources Commission. The Commission may require the restoration of the portion of the premises visible at low tide upon termination of a lease or permit. The lessee must exercise a high degree of care t prevent pollution from arising from its operation The Commission may grant an extension of a leas when the lessee must acquire a federal or state pe mit for construction of a drilling platform. The le sce must commence drilling within five years fro the date of the lease and commence productio within three years of discovery. A lessee may n assign his lease without Commission approval. Th state reserves the right to permit reasonable no conflicting uses of the land covered in the leas The lessee may surrender the lease subject to th duty to pay all rent and royalties and to place a production facilities in condition for abandonmen Upon default by the lessee, the state may cancel th lease. The Commission must give notice by publ cation of all offers to lease. The successful bidde must pay the cash bonus and first year's rent in ac vance. The Governor and Commission shall e ecute the lease. The Commission is empowered t make rules and regulations to regulate surveys an production operations. The Department of Defens must approve all leases and permits prior to the approval by the state. (Gadd-Fla)
W69-09548

INTERNAL ORGANIZATION AND POWER OF TAX DITCH.

Del Code Ann tit 7, secs 4151-4168 (1953), a amended, (Supp 1966).

Descriptors: *Delaware, *Taxes, *Drainage pr grams, *Administrative agencies, Assessments, Ta rate, Ditches, Legislation, Legal aspect Economics, Costs, Drainage, Drainage system Administration, Drainage practices, Capital, Co allocation, Resource allocation, Eminent domai Proprietary power.
Identifiers: Tax base.

Managers for the tax ditch are elected by the taxa bles within the ditch area at an organizationa meeting called by the state drainage engineer soo after the ditch order becomes final. While ditc managers may meet as often as is necessary to co duct business, annual meetings are held in which a taxables may take part. The powers of a tax ditc include levying taxes, making and executing nece sary instruments, borrowing money, exercisin eminent domain, and maintenance of the tax ditc under certain circumstances. Ditch managers performing their duties must determine from th taxables the desired programs of operation, dete mine the amount of taxes necessary for such pr grams, secure from the majority of taxables votin specific authority to borrow money for the ta ditch, and perform a number of other tasks nece sary for the tax ditch to operate smoothly. Th secretary-treasurer of the tax ditch who must b bonded keeps minutes of all meetings of the ta ditch managers and prepares an annual financi statement. The tax ditch may borrow up to 90% o the total assessment base established by the ditc order. (Johnson-Fla)
W69-09549

CONSERVATION.

Del Code Ann tit 7, secs 2710-2717 (Supp 1966).

Descriptors: *Delaware, *Shellfish, *Fish conse vation, *Regulation, Legislation, Oyster Dredging, Boats, Ships, Fishing, Fishing gear, Com mercial fishing, Commercial shellfish, Adjudicatio procedure, State jurisdiction, Conservation, Fis management, Legal aspects, Jurisdiction.
Identifiers: Penalties (Civil), Penalties (Criminal Liens.

The captain of any watch boat is authorized to seiz any vessel used in violation of shellfish laws and a rest its crew when he has reliable information o such illegal use or upon warrant issued by a justic of the peace. The justice of the peace shall fix hearing date, which shall be not more than 5 day from the arrest. Upon conviction a fine shall be im

osed upon the defendants which shall constitute a en on the seized vessel. Upon failure to pay the ne within 15 days the vessel shall be sold at public uction. Defendants may appeal to the superior ourt upon posting of bond in double the amount of ne fine. When a vessel is sailing over oyster rounds with dredges overboard and attended, it nall be conclusive evidence that such vessel is redging for oysters. Any justice of the peace of his state shall have jurisdiction over every viola- on of the provisions of this chapter. Violators may e punished by fine not less than $100 nor more han $1000 and upon failure to pay such fine im- risoned not less than one nor more than six nonths. (Kahle-Fla)
V69-09553

ONSERVATION--TAKING OF LOBSTERS.

el Code Ann tit 7, secs 2501-2504 (Supp 1966).

escriptors: *Delaware, *Lobsters, *Fish conser- ation, *Regulation, Atlantic Ocean, Legislation, ish management, Wildlife conservation, State ju- sdiction, Fishing gear, Trapping, Seasonal, pawning, Shellfish, Commercial shellfish, Com- ercial fishing.
dentifiers: *State waters, Penalties (Civil), Penal- es (Criminal), Lobster pots.

obsters may not be taken in state waters between eptember 1, and April 30, or between 2:00 PM aturday and 12:00 midnight Sunday. Lobsters ay not be taken except by lobster pot, trap or set. lo more than 50 such pots or traps may be used at ne time. Pots or traps may not be connected ogether in any manner. No spawning lobster, or obster measuring less than 3 1/8 inches from the ear of the eye socket to the rear of the body shell ay be taken in state waters, including the Atlantic Ocean within 3 miles of the coastline. Lobsters less han 3 1/8 inches may not be possessed or sold i thin the state no matter where taken. Lobsters ay not be taken from state waters by non-re- idents or aliens. Taking, possessing, or selling un- ersized lobsters is punishable by $5 fine for each uch lobster or imprisonment of not more than 15 ays. Other violations of these provisions are unishable by fines not less than $20 or, upon ailure to pay the fine, imprisonment of not more han 30 days. Aliens and non-residents may be ined not less than $50 for violations. (Kahle-Fla)
V69-09556

RGANIZATIONAL ALTERNATIVES FOR RECREATIONAL RESOURCE MANAGEMENT: N ANALYSIS OF STATE AGENCIES,
or primary bibliographic entry see Field 06B.
V69-09561

WATER LAW--THE RISE AND FALL OF NEW MEXICO'S TEMPLETON DOCTRINE,
Timothy W. Glidden.
Natural Resources Journal, Vol 6, No 2, p 325-333, Apr 1966. 9 p.

Descriptors: *Surface-groundwater relationships, Judicial decisions, New Mexico, Prescriptive ights, Water transfer, Adjudication procedure, Relative rights, Water law, Legal aspects.
dentifiers: Impairment of existing rights.

The interrelationship of surface and groundwaters as long been an axiomatic concept in hydrology; he problem is incorporating the concept into the egal structure. Public waters in New Mexico are egulated under two outdated classifications-- roundwaters and surface waters. The surface-right older of a given amount of public water from a iven source has no means of replenishing his sur- ace supply when it is depleted. The Templeton ecision, which allowed Templeton to follow his urface right to its source by changing his point of iversion from a surface appropriation to a ground ppropriation, appeared to represent a reakthrough in New Mexico law. Subsequent cases revealed that Templeton was not a universal solution, primarily because of problems involving impairment of existing rights. The article urges that impairment problems created by transfers be faced squarely rather than avoided by eliminating the possibility of transfers. The legislature should recognize that transfers are necessary and possible under certain circumstances and should incor- porate that recognition into law. The results would ease the limitations on surface-right holders and contribute materially to revising the obsolete clas- sification of public waters. (Gossen-Chicago)
W69-09562

CONSOLIDATION OF WATER CONTROL COMMISSION AND WATER RESOURCES BOARD.

NH Rev Stat Ann secs 481:22-481:24 (1968).

Descriptors: *New Hampshire, *Administrative agencies, *Water policy, *Administration, Legisla- tion, Legal aspects, Water law, Political aspects, State governments, Governments, Water policy, Water control.

The state Water Control Commission is merged with the Water Resources Board which must discharge all the duties and obligations which were assigned to the Commission. The Board continues to be a corporation under the laws of New Hampshire and is subject to the same obligations and duties as prior to the merger and retains the same rights, powers, privileges and immunities as before. (Johnson-Fla)
W69-09567

POLLUTION: REGULATION AND THE ANTITRUST LAWS,
For primary bibliographic entry see Field 05G.
W69-09577

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION).
Committee on Marine Science, Engineering and Resources, Washington, D.C.

Report of the Comm on Marine Science, Engineer- ing and Resources, p 49-81, Jan 1969. 33 p, 3 tab, 3 fig.

Descriptors: *Coasts, *Federal government, *Oceans, *Management, Beaches, Coastal en- gineering, Coastal structures, Harbors, Law of the sea, International law, Shores, Fishing, Oil, Indus- tries, Exploration, State governments, Administra- tive agencies, Pollution, Pollution abatement, Pol- lution control, Costs, Manpower, Recreation, Wastes.
Identifiers: Coastal management system, Waste management.

To insure effective use of coastal areas, a sound management system must be devised that will give developmental alternatives, provide for proper planning and recognize the importance of this productive region. Coastal zone uses are varied and any management system must cope with all uses and rights. Uses of the coastal area are intensifying and moving seaward. Shoreline and offshore indus- trial uses demand that a management system deal with problems accompanying this movement. The Commission on Marine Science, Engineering and Resources recommends federal legislation to establish a coastal zone policy putting the manage- ment in federally funded state authorities. The authorities would be independent and would have sufficient power to accomplish their objectives. To protect national interests, actions would be subject to federal review. To establish a basis for decision making, continuing surveys and studies of the coastal zones must be made and data compiled. Ef- fective use of these zones demands coastal pollu- tion be abated and programs for achieving and maintaining water quality invoked. Such pollution programs must be in the context of and integrated with waste management in the entire environment. (Helwig-Fla)
W69-09578

THE COMMON LAW BACKGROUND OF THE RIPARIAN DOCTRINE,
T. E. Lauer.
Mo L Rev, Vol 28, No 1, p 60-107, Winter 1963. 48 p, 218 ref.

Descriptors: *Water law, Reasonable use, *Natural flow doctrine, *Riparian rights, Publications, Legal aspects, Water utilization, Diversion, Prior ap- propriation, Water rights, Riparian land, Water- courses (Legal), Public rights, Civil law.

A thorough presentation of the common law development of English water use law is made. The origin of the American doctrine of water use, whereby each owner of land upon the banks of a watercourse has a right to make a reasonable use of the water, is customarily placed shortly after the year 1825. This riparian doctrine has been ascribed to Joseph Story and James Kent. In the years fol- lowing 1825, the English courts were to abandon prior use and to embrace instead the natural flow doctrine. Then in 1851, the court of Exchequer adopted the American riparian doctrine with its basis of reasonable use. In 1825, the common law contained the seeds of the reasonable use test; the development across the centuries had been in the direction of a flexible standard enabling the greatest beneficial use of watercourses. Story and Kent, conversant with this common law background, drew heavily upon the Code Napoleon and Roman law in constructing the riparian doctrine. But, the continental legal system can be assigned only a paternal role. The gestation of the doctrine occurred within the matrix of the common law, over centuries of judicial experience and growth. (Childs-Fla)
W69-09579

A UNIFIED CABINET-LEVEL DEPARTMENT OF WATER DEVELOPMENT AND OPERATION HAVING FULLY COORDINATED FUNCTIONAL SERVICES TO MEET MODERN NEED. NATIONAL AND INTERNATIONAL,
Shu-t'ien Li.
Int'l Conference on Water for Peace, Washington: U.S. Government Printing Office, Vol 5, p 365- 371, 1967. 7 p. For 8 volume Proceedings see Vol 2, No 9, Field 6B, W69-03305.

Descriptors: *Water resources development, *Regulation, *Administration, Water allocation (Policy), Surveys, Research and development, Federal government, Political aspects, Social aspects, Interstate rivers, Watersheds (Basins), Publications, Institutions, Administrative agencies, Data collections, Conservation, Water supply, Waste-water (Pollution), Reclamation, Flood con- trol, Water pollution control, Hydrodynamics.

Government agencies for water development and operation can be most efficiently organized on the multi-phase principle of streamlined unification, coordinated functional services, optimum cen- tralization, and dynamic cooperation among all concerned. The basic framework of such an or- ganization is presented. The components of the proposed organization are: (1) national hydro-data service; (2) national hydro-conservation service; (3) national water supply service; (4) national waste-water sanitation service; (5) national recla- mation and flood control service; (6) national hydroelectric power service; (7) waterways, har- bors, and maritime administration; (8) water pollu- tion control administration; (9) interstate water ad- ministration; (10) international cooperation ad- ministration; (11) water development financing ad- ministration; (12) water research and development administration; and (13) wet space administration. It is submitted that only a unified cabinet-level de- partment of water development and operation may generate fully coordinated functional services to meet modern water needs of mankind. (Childs-Fla)
W69-09580

ROLE OF STATE GOVERNMENTS IN U. S. WATER MANAGEMENT,
Dwight F. Metzler.
Int'l Conference on Water for Peace, Washington: US Government Printing Office, Vol 5, p 402-407, 1967. 6 p.

Descriptors: *State government, *Water resources development, *Water policy, *Water allocation (Policy), State jurisdiction, Planning, Political aspects, Management, Social aspects, Regulation, Coordination, Water problems, Resource allocation, Water utilization, Water quality, Projects, Federal government, Administrative agencies, Flood control, Water control, Competing uses, Water rights, Withdrawal, Publications.

The primary responsibility for managing water rests with the states. This includes allocating water among competing uses, protecting rights to water, controlling withdrawals, preventing water pollution, and making water available to support the maximum economic development. The federal government has led in river basin planning and in the construction of large projects. The amount of state participation in meeting water needs varies widely. The most successful states have a strong program of: (1) basic data collection; (2) planning; (3) policy development; (4) implementing legislation; and (5) public education. The progressive states have provided leadership in solving their problems through strong financial support and by attracting staffs skilled in engineering, economics and law. They have developed an active partnership with both local units of government and the federal agencies. While the responsibility for policy making is not always centralized, it is clearly defined and carried out with close cooperation between the legislative and executive departments of state government. (Childs-Fla)
W69-09581

CONGRESS AND THE NATION'S WATER RESOURCES,
Walter Rogers.
ABA Section of Mineral and Natural Resources Law (1962 Proceedings), p 113-119, 1962. 7 p.

Descriptors: *Federal-state water rights conflicts, *State governments, *Federal Government, *Water rights, Political aspects, Local governments, Desert Land Act, Legislation, Public lands, Unappropriated water, Federal reclamation law, Water resources development, Navigable waters, Legal aspects, Governments.

The author discusses the problem of the federal government versus the state governments with reference to water rights. He discusses the historical background of the problem detailing the evolution of federal control over navigable waterways and federal activity in the area of flood control. Since World War II federal activity in the field of water resources has expanded to encompass virtually every phase of water resources development. The author then delves into the potential conflicts between state and federal government in respect to water rights. The fear in western states has arisen that the federal government proposed to take away without compensation, existing water rights secured under state law. Various congressional efforts to resolve the problem have been attempted and the author outlines these efforts. The author concludes with a plea to the legal profession to abandon the role of advocate of a position on the issue to study it objectively, and then to join with the Congress in finding a solution to the federal-state conflict over water. (Shevin-Fla)
W69-09582

ALABAMA RIVER DEVELOPMENT AUTHORITY.
Ala Code tit 55 secs 373 (6f) - 373 (6j) (1960), as amended, (Supp 1967).

Descriptors: *Alabama, *Administrative agencies, *Water resources development, *River systems, Legislation, Regulation, Local governments, Administration, Coordination, Planning, Water policy, Water allocation (Policy), Rivers, Channels, Surveys, River basin development.

Alabama's water resources are of major importance for the industrial development and economic expansion of the state. To further these goals, the Alabama River Development Authority is created to develop the state rivers and waterways. The Alabama River Development Authority has the following powers and duties: (1) to contract with local governments in order to make studies and surveys of the state river system; (2) to investigate and make surveys of the state river system and to secure development of an inland waterway system; (3) to cooperate with local governments and organizations and to encourage efforts to secure development of state rivers; (4) to aid in securing federal legislation supporting river development and to secure federal funds; (5) to promulgate rules and regulations; and (6) to exercise such appropriate powers as will enable the accomplishment of the promotion, planning, and engineering of river and waterway development. Funds are appropriated to carry out the provisions of this article. (Childs-Fla)
W69-09583

STATE LABORATORY OF HYGIENE.
For primary bibliographic entry see Field 05F.
W69-09584

RIVERS AND CREEKS.
N C Gen Stat secs 77-1 - 77-14 (1965), as amended, (Supp 1967).

Descriptors: *North Carolina, *Rivers, *Channel improvement, *Obstruction to flow, Legislation, Local governments, Regulation, Administrative agencies, Streams, Slopes, Dams, Fish passages, Gates, Mill dams, Lumbering, Bridges, Navigable waters, Fish guiding, Drainage ditches.

The Board of County Commissioners may appoint commissioners to perform various functions concerning rivers or streams running through the county. The commissioners shall clear and lay off rivers and creeks in their respective counties leaving three-fourths of such waters for the owners for erecting slopes, dams and stands and one-fourth for the passage of fish in such rivers or streams. The owner of any mill shall maintain a gate and slope to be used for floating logs. Any stream used to propel machinery which becomes diverted may be returned to its channel. Any person owning a boat plying any river or creek which might be considered non-navigable may make a draw in any bridge which obstructs passage. The Board of County Commissioners may establish public landings on any navigable stream or watercourse in the county. Obstructing free passage of boats along any river or creek is a misdemeanor. Lessening the natural flow of water along a natural water passage by obstruction is a misdemeanor. However, the erection of fish dams or hedges not extending across more than two-thirds of the width of any stream is lawful. The obstruction of streams and drainage ditches whereby the drainage is impeded is unlawful. (Childs-Fla)
W69-09585

BRINKLEY V EATON (RESPONSIBILITY FOR NATURAL ALTERATION OF FLOW).
39 So 2d 491-494 (Miss 1949).

Descriptors: *Mississippi, *Surface waters, *Relative rights, *Alteration of flow, Land tenure, Judicial decisions, Surface runoff, Surface drainage, Canals, Ditches, Drainage, Diversion structures, Water conveyance, Natural flow.

Complainant and defendant owned large tracts of adjacent land. Defendant's land was bounded on one side by an artificial canal. For years a natural watercourse flowed across complainant's land onto defendant's land and then turned naturally back onto other land of complainant. In 1912, the can and an artificial ditch were dug on defendant's lan diverting the natural water from its course. Th ditch continuously filled and overflowed despi defendant's efforts to keep it clear after his acquis tion of the land in 1941. Complainant claime damages from the natural water which had reverte to its original course and sought an injunction t force defendant to maintain the artificial ditch. C appeal from dismissal of the complaint, th Supreme Court of Mississippi held due to th topography of defendant's land, it would impos too great a burden upon him to require restoratio of the ditch. The court held an owner of land w not required to maintain artificial drains when ac of nature made it unreasonable or impossibl (Harris-Fla)
W69-09586

WATER AREAS BEAUTIFICATION.
W Va Code Ann, sec 20-5-14 thru 20-5-16 (1966

Descriptors: *Water pollution sources, *West Vi ginia, *Water resources development, *Water po lution, Rivers, Legislation, Streams, Basins, Lake Ponds, Watercourses (Legal), Water policy, Reg lation, Water pollution control, Waste disposa Legal aspects.
Identifiers: Penalties (Civil), Penalties (Criminal)

The Division of Water Resources is responsible f the department's program for husbandry of wat areas (except farm ponds) and the immediately a jacent lands. The chief of the division makes su veys, conducts public meetings, and takes suc other steps as may be expedient to improve all suc water areas. He cooperates with the department chief law enforcement officer and all other prop law enforcement agencies in enforcing the prov sions of the law prohibiting the disposal of litter or near such water areas. It is unlawful to deposit cause to be deposited any litter in a water area within one hundred yards thereof, or in such loc tion that high water or normal drainage conditio will cause the material to be washed into any suc water area. This does not restrict an owner's use his private property nor the disposal of industri wastes consistent with the provisions of article fiv A of this chapter. If an owner dumps materials that high water or normal drainage conditio cause them to wash into a watercourse, it will b prima facie evidence that the owner intended violate the provisions of this section. The prov sions of this article are severable. (Gabrielson-Fla
W69-09587

JURISDICTION OF COUNTY LYING O NAVIGABLE RIVER.

Md Ann Code art 75 secs 81, 82 (1957).

Descriptors: *Maryland, *Jurisdiction, *Navigab rivers, Legislation, Local governments, Leg aspects, Political aspects, Channels, Boundari (Property).

Counties lying on navigable rivers shall extend the jurisdiction from the shore to the channel of t river that divides the counties except where a divi ing line has been fixed by law. The jurisdiction every county bounded at any point by navigab waters shall extend from the shore to the inside the channel, which shall be regarded to be t center of said waters, except where said waters a join neighboring states, in which case the jurisdi tion shall continue to the ultimate limits of t state. (Childs-Fla)
W69-09588

WATER AND SEWERS.
Md Ann Code art 23B, secs 78-92 (1966), amended, (1968).

Descriptors: *Maryland, *Cities, *Water suppl *Drainage, Sewage, Municipal wastes, Sanitary e gineering, Sewers, Sewage treatment, Cesspoo

ewage disposal, Pipelines, Conduits, Drainage stems, Storm drains, Leakage, Water pollution, ater rates, Water wells, Surveys, Condemnation, ublic health, Gutters, Taxes, Boundaries (Proper-), Plumbing, Maintenance.
entifiers: *Sewerage systems.

ny city may construct and maintain water stems, sewerage systems and drainage systems, id do all things necessary for the efficient opera- on of such systems. Any company placing or anging any structure in the public way must ceive authorization from the city. Any structure peding the city water pipes may be ordered moved by the city, and they can use their con- mnation power if necessary. The city may enter on the county public way for the purposes of nstructing or maintaining its water systems ithout obtaining a permit. The city shall provide nnections with water and sewer mains for utting property owners and may order existing sspools and wells filled for the benefit of public alth. A uniform charge may be levied for these nnections. The city may require changes in umbing to prevent waste or improper use of ater. The city may prohibit the operation of ivate water systems and provide for the sanitary aintenance of other private sewage systems. The ty may extend its systems beyond the town boun- aries. City employees may enter private property examine the water systems. No person shall pol- te water used in the water supply. Service rates r water may be charged and special assessments vied to pay for the systems. (Shevin-Fla)
/69-09589

RAINAGE DISTRICTS.

Id Ann Code art 25, secs 96-122 (1957), as mended, (Supp 1968).

escriptors: *Maryland, *Drainage districts, Reclamation, *Drainage programs, Swamps, larshes, Public benefits, Highways, Legislation, itches, Canals, Levees, Watercourses, Costs, As- ssments, Cost-benefit analysis, Federal govern- ent, State governments, Loans, Feasibility stu- ies, Local governments, Legal aspects.

ounty commissions are authorized to establish rainage districts upon petition of a majority of the ndowners in the proposed district. The commis- on shall appoint a board of viewers to establish e feasibility, costs, and benefits of such a district. the viewers' report is favorable the district shall e established and a board of drainage commis- oners appointed to supervise drainage construc- on, assess costs, and issue bonds for the project. he districts are authorized to utilize federal funds at may become available for their projects upon pproval of affected landowners. A state 'Drainage istrict Fund' is created to provide loans to aid in efraying initial costs of drainage district projects. Kahle-Fla)
/69-09590

RAINAGE DISTRICTS.

Id Ann Code art 25 secs 96-99 (1957), as mended, (Supp 1968).

escriptors: *Maryland, *Drainage districts, Reclamation, *Drainage programs, Surveys, ublic benefits, Cost-benefit analysis, Ditches, anals, Watercourses, Levees, Drainage, Swamps, arshes, Cultivation, Administrative agencies, Ad- inistrative decisions, Feasibility studies, Legisla- on, Engineers estimates, Costs, Cost analysis, rainage engineering, Legal aspects.

he county commissioners of any county may stablish levees or drainage districts and construct r improve ditches, canals, watercourses or pump- ig plants in order to drain and reclaim swam- lands. Whenever a majority of the landowners in a roposed district or owners of 3/5 of the land to be ffected by the proposed improvements petition to ie county court setting forth the location of the land and alleging that the land is too wet for cultivation and will be benefited by draining, ditching or leveeing and there is filed a bond in the amount of $50 per mile for such improvement, the clerk shall issue a summons to all non-signing landowners. Upon the return day the commissioners shall appoint a civil and drainage engineer and two freeholders of the county as a board of viewers to examine the lands and report thereon. The report shall set forth: whether the proposed drainage is practicable, whether it will be of benefit to the general welfare of the community or to a public highway, whether the benefit is sufficient to warrant the probable expenditure, and whether or not all the lands to be benefited are included in the proposed district. If the report is favorable the viewers shall be instructed to make a complete survey, draw plans, and estimate costs. If the report is unfavorable, the petition shall be dismissed. (Kahle-Fla)
W69-09591

DRAINAGE DISTRICTS.
Md Ann Code art 25 secs 100-107 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Drainage districts, *Surveys, *Cost-benefit analysis, Assessments, Highways, Public benefits, Railroads, Legislation, Administrative agencies, Administrative decisions, Drainage programs, Ditches, Canals, Levees, Feasibility studies, Legal aspects, Maps.

The board of viewers shall make a complete survey of the proposed district marking the line of each ditch, drain or levee. A drainage map of the district shall be made showing the location of each improvement and the boundaries of each landowner. Locations of highways, railroads, and incorporated towns shall be set out. The viewers shall also assess damages to any landowners occasioned by the improvements. The benefited land shall be separated into 5 classes from highest benefit to least benefit to be used as a basis for assessment to the landowners. A final hearing shall be set for a date not less than 30 days after acceptance of the report by the commissioners. All non-signing landowners in the proposed district shall be summoned. At the final hearing any landowner may file a written objection to the viewers' report. If the commissioners find that the benefits to the land will outweigh the costs the district shall be established. If not the proceedings shall be dismissed at the cost of the petitioners. (Kahle-Fla)
W69-09592

DRAINAGE DISTRICTS.
Md Ann Code art 25 secs 108-117 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Construction costs, *Assessments, *Drainage districts, Drainage programs, Administrative agencies, Highways, Cost-benefit analysis, State governments, Right-of-way, Drains, Laterals, Financing, Legislation, Costs, Local governments, Projects.

The county commissioners shall appoint three freeholders as the board of drainage commissioners for the established district. The board shall appoint a superintendent of construction and fix his compensation. The drainage commissioners shall ascertain and certify to the county commissioners the total construction costs and bond interest for a period of three years after construction. After the total costs are ascertained the drainage commissioners shall prepare assessment lists for each landowner to cover the period of the bond issue that will finance the project. If any highway or other public property is to be benefited the state shall be assessed for its share of benefits. Lands within the district not benefited shall not be assessed. Rights-of-way for drainage may be aquired by purchase or condemnation. Assessed landowners shall have the right to use the ditch or drain as an outlet for lateral drains. (Kahle-Fla)
W69-09593

DRAINAGE DISTRICTS.
Md Ann Code art 25 secs 118-122 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Construction, *Construction costs, *Drainage districts, Drainage programs, Contracts, Federal government, Loans, Maintenance, Repairing, Assessments, State governments, Local governments, Administrative agencies, Costs, Legislation, Financing, Bids.
Identifiers: Negligence.

The board of drainage commissioners shall advertise for construction bids to be let to the lowest responsible bidder. Whenever an improvement is completed it shall be the duty of the drainage commissioners to maintain and repair the improvement and assess the benefited lands. If repairs are made necessary by the negligence of a particular landowner, he shall be assessed and his lands levied against for the repair costs. The drainage districts are authorized to avail themselves of any federal loan provisions for the operation of drainage districts that may be enacted, but no such agreements between the federal government and the drainage districts shall be valid until a majority of landowners in the district have given written approval to the contract. The 'Drainage District Fund' is established and $10,000 is appropriated from the treasury to this fund for loans not to exceed $2,000 to any one district for expenses incurred up to the time of the establishment of the drainage district. (Kahle-Fla)
W69-09594

RIVERS, HARBORS.
For primary bibliographic entry see Field 05G.
W69-09595

POLLUTION OF SOURCES OF WATER SUPPLY.
For primary bibliographic entry see Field 05G.
W69-09596

LAW ON THE POTOMAC RIVER.

Md Ann Code art 66C secs 306 thru 313 (1957).

Descriptors: *Maryland, *Commercial fishing, *Permits, *Regulation, Fish, Oysters, Crabs, Fyke nets, Gill nets, Nets, Fishing gear, Fish conservation, Navigable waters, Taxes, Legislation, Herring, Jurisdiction, Legal aspects, Virginia, State jurisdiction.
Identifiers: *Potomac River, Shad, Penalties (Civil), Penalties (Criminal).

Citizens of Maryland and Virginia who have been residents for 12 months may take fish, oysters, and crabs from the Potomac River upon compliance with Maryland law. Any citizen fishing for market or profit with pound, fyke, gill, sturgeon or skirt nets, haul seines, weirs or other devices, must obtain a seasonal license from an authorized Maryland officer and pay a prescribed tax. Officers have the right and duty to examine the right of persons taking catches, and may pursue and arrest violators of Maryland law outside the jurisdiction on navigable waters. Offenses may be punished by magistrates or Maryland courts of criminal jurisdiction. The use of certain sizes and types of nets is absolutely prohibited. The use of floating or drift nets or stake gill nets is prohibited except during shad and herring season in designated counties. The failure of persons to comply, or officers to enforce the laws of Maryland shall be punishable by fine and/or forfeiture of equipment as designated in the act. (Harris-Fla)
W69-09597

BOARD OF LEVEE COMM'N V WINEMAN (EMINENT DOMAIN PROCEEDINGS).

222 So 2d 683-685 (Miss 1969).

Descriptors: *Mississippi, *Levees, *Eminent domain, *Administrative decisions, Administrative agencies, Legal aspects, Judicial decisions, Easements, Condemnation, Legislation, Soil structure, Construction, Regulation, Berms, Engineering, Land tenure, Drainage, Excavation, Subsurface waters, Mineral industry, Floods, Flood control, Water management (Applied), Real property.

Plaintiffs had taken fee simple title to defendants' land by eminent domain. The land was taken in order to obtain soil to be used in improving and enlarging levees and for the construction of berm for reinforcement of the levee. Defendants sought to have the taking of fee simple title declared void and only an easement granted. Plaintiffs declared the taking of fee simple title to be of public necessity. The lower court held there was no public necessity for taking fee simple title, but on appeal the supreme court held the plaintiffs had not exceeded their discretion and could take a fee simple title. The court held that any administrative decision by the board would be upheld unless it was shown to be a manifest abuse of their discretion. In this case the evidence showed that the taking of fee simple title was a necessary increment to the efficient operation of the levee. The court found that the plaintiffs had not abused their discretion and could take fee simple title to the land. (Shevin-Fla)
W69-09598

FOOD SANITATION: (SHELLFISH).
NH Rev Stat Ann secs 143:20 thru 143:28 (1964), as amended, (Supp 1967).

Descriptors: *New Hampshire, *Regulation, *Shellfish, *Commercial fishing, Legislation, Oysters, Clams, Mussels, Public health, Mollusks, Commercial shellfish, Aquatic animals, Aquiculture, Fish handling facilities, Commercial fish.

The sale of shellfish taken from specified areas is regulated by the Division of Public Health Services of the state of New Hampshire. A certification by the Department of Health and Welfare is required prior to operation of a shellfish processing and packing business. The certificate may be revoked after notice if the establishment is deemed to be unsanitary in the conduct of its operations. Penalties of from twenty-five dollars to not more than two-hundred dollars or imprisonment for not more than sixty days, or both are provided. (Moulder-Fla)
W69-09599

OYSTERS.
Del Code Ann tit 7, secs 2101-2110 (Supp 1966).

Descriptors: *Delaware, *Oysters, *Commercial shellfish, *Regulation, Administrative agencies, Legislation, Water law, Water policy, Commercial fishing, Shellfish, Boundaries (Property), Ownership of beds, Riparian waters, Water rights, Preferences (Water rights), Legal aspects, Jurisdiction, Permits, Beds under water, Riparian rights.
Identifiers: Culling, Limits, Licenses.

One must purchase an appropriate license to take oysters in Delaware, but even with a license it is considered larceny to take oysters from the bottom or plantation of another. Oysters may not be taken at night. Plant and seed oysters taken in tributaries of the Delaware Bay must be culled and thrown back where they are caught. Twenty-five bushels per day is the limit on oysters in such waters and enforcement officials may board any boat taking oysters for inspection of such limit and to see that oysters are properly culled. Oysters may be planted in certain areas if the owner of such beds marks them with stakes. Another method of obtaining exclusive rights to oyster on a bed is to lease the bed from the state. (Johnson-Fla)
W69-09600

HIGHWAYS: (HIGHWAYS, ROADS, AND BRIDGES GENERALLY).

Del Code Ann tit 17, secs 504, 511 (1953), as amended, (Supp 1966).

Descriptors: *Delaware, *Drainage, *Flood control, Drainage systems, Ditches, Drains, Streams, Creeks, Culverts, Sewers, Damages, Jurisdiction, Flood protection, Water control, Channel improvement, Bridges, Administrative agencies, Legislation.

The Highway Department may maintain free passage of water for the drainage of any road, bridge, or causeway under its jurisdiction. To accomplish this objective, the Department may enter lands adjacent to a road or causeway for the maintenance or repair of any drainage system. Damages sustained by the owner of the adjacent land as a result of Road Department action are to be adjusted by agreement between the Department and the owner or by the Court of Common Pleas. Provisions regarding the wilful or negligent damage to any public bridge or drain, or any appurtenance maintained and used for the convenience or safety of the public are set forth. The injuring party is to forfeit and pay double damages. The action for damages is to be brought in the name of the state with all money being paid to the state treasurer. (Moulder-Fla)
W69-09601

DELAWARE MEMORIAL BRIDGE.
Del Code Ann tit 17, secs 301, 306, 308, 323 (1953), as amended, (Supp 1966).

Descriptors: *Delaware, *Regulation, *Bridges, *Bridge construction, Legislation, Condemnation, Submerged land, Land use, Eminent domain, Jurisdiction, Riparian rights, State governments, Land appraisal, Pollution, Beds under water, River beds, Delaware River, Administrative agencies, Ownership of beds, Construction costs.

Delaware may purchase property within the states of Delaware and New Jersey for the construction, maintenance, and operation of the Delaware Memorial Bridge and all approaches thereto. Delaware consents to the use of its lands under the Delaware River which are deemed necessary to the construction and operation of such bridge. The attendant power to collect and pledge tolls is also set forth, along with the purposes to which the monies so collected shall be put. (Moulder-Fla)
W69-09602

SOIL CONSERVATION DISTRICTS PROJECTS.
NH Rev Stat Ann secs 481:25-481:28 (1968).

Descriptors: *New Hampshire, *Soil conservation, *Watershed management, *Water management (Applied), Governments, Financing, Costs, Legislation, Legal aspects, Water law, Federal government, Local governments, Soil management, Water conservation, Flood control, Water policy, Administration, Dam construction, Allotments, Government finance, Participating funds.

To cooperate fully with federal agencies in watershed management all jointly sponsored soil conservation district's projects are declared projects under provisions of this chapter and all property and rights acquired for such projects which are nonrevenue producing are tax exempt. The water resources board shall cooperate with cities and towns in the development of small-watershed projects as planned by the soil conservation service of the United States Department of Agriculture and local sponsoring organizations. The exercise of eminent domain, however, may not be applied to any lands needed to allow the enlarging of a dam beyond the height or length needed solely for flood control purposes. Upon review and approval by the state soil conservation committee, state financial aid for such projects is available through the small-watershed fund, provided the town joining in the project matches equally such funds. Wh highways must be relocated due to such proje the cost will be paid bythe sponsoring agen (Johnson-Fla)
W69-09603

STATE DAMS, RESERVOIRS AND OTH WATER CONSERVATION PROJECTS.
NH Rev Stat Ann secs 481:1-481:21 (1968).

Descriptors: *New Hampshire, *Administrati agencies, *Dams, *Water conservation, Legis tion, Water law, Water policy, Legal aspects, A ministration, Jurisdiction, Financing, Judicial de sions, Public health, Economics, Local gove ments, Federal government, Reservoirs, Flood co trol, Impounded waters, Interstate compacts, Co tract administration, Maintenance, Manageme Projects, Gaging stations.

Conservation and distribution of water is in t public interest and thus requires projects for t conservation, development, storage, distrib tion,and utilization of water. The New Hampsh Water Resources Board has the power to engage projects within the state and in cooperation wi other states and the federal government to me these needs. The management and general pow of the board are set out in detail with spec reference to the board's powers to make certa contracts, acquire certain property, and change t locations of highways and bridges in connecti with such projects. Regulations for reservoir ope tion and delineation of types of unlawful use 'stored water' preceed a number of financial pro sions relating to tax exemption of properties used the construction and maintenance of dams a reservoirs, bond authorization, and remed available to such bondholders. There is provisi for the entrance into certain interstate compacts well as for cooperation with the federal gove ment in the establishment and maintenance stream flow gauging stations. (Johnson-Fla)
W69-09604

STATE DAMS, RESERVOIRS AND OTH WATER CONSERVATION PROJECTS.
NH Rev Stat Ann secs 481:1-481:3 (1968).

Descriptors: *New Hampshire, *Water conserv tion, *Water policy, *Administrative agencies, A ministration, Water law, Legal aspects, Legislatio Financing, Economics, Water utilization, Flo control, Projects, Governments, Regulation, Wat resources development, Water resources, Dam Reservoirs.
Identifiers: Corporations (Public).

There is a state wide need for the conservation a distribution of water and the regulation of the flo of rivers and streams. The public interest, welfa and necessity requires the construction of projec for these purposes to lessen flood damage and promote the state's economic welfare by enhanci the present and potential water power along rive through the construction, maintenance, and oper tion of dams and reservoirs. A public corporati known as the New Hampshire Water Resourc Board has power to engage in such projec Among the specific powers of the Board are the f lowing: purchasing, condemning, leasing or othe wise obtaining property for the state as deem necessary for its corporate purposes; constructi and maintaining projects; charging and collecti fees for water use; paying surplus revenues into t state treasury; exercising its powers in adjoini states as permitted by law; borrowing money; a making and issuing negotiable notes and bonc (Johnson-Fla)
W69-09605

STATE DAMS, RESERVOIRS AND OTH WATER CONSERVATION PROJECTS.

NH Rev Stat Ann secs 481.4-481.10 (1968).

Descriptors: *New Hampshire, *Administrative agencies, *Projects, *Water conservation, Judicial decisions, Administration, Legislation, Legal aspects, Water law, Political aspects, Water policy, Contract administration, Contracts, Economics, Eminent domain, Regulation, Financing, Jurisdiction.

The corporation is managed by five directors with special restrictions as to political affiliation and salary. The corporation has the general powers of New Hampshire Corporations and may accept cooperation from the United States or its agencies. The board, before commencing any project, must submit a detailed description and plan to the governor and council for their approval. Upon an order from the governor and council directing the board to proceed with a project, the board shall complete contracts with such persons or corporations as may be specially benefitted by such projects, including users of water in and outside the state for power and other purposes, covering terms under which such persons or corporations shall pay for such benefits. There is provision for a judicial determination in the superior court of reasonable compensation for such use when either a user declines to enter into such a contract or where the parties cannot agree on the amount of compensation for such use. The corporation may purchase or otherwise acquire for just compensation such real property as is necessary for a project. (Johnson-Fla)
W69-09606

STATE DAMS, RESERVOIRS AND OTHER WATER CONSERVATION PROJECTS.
NH Rev Stat Ann secs 481:11-481:14-a (1968).

Descriptors: *New Hampshire, *Local governments, *Water policy, *Water conservation, Legislation, Legal aspects, Water law, Contracts, Water utilization, Reasonable use, Riparian rights, Administration, Administrative agencies, Riparian land, Flow control, Flood control, Flow rates, Water control, Reservoirs, Economics, Taxes, Government finance, Judicial decisions, Jurisdiction.

When the corporation fails to agree with a municipal government on the appropriate relocation of a highway, bridge, electric transmission or distribution line, it may institute proceedings in the county superior court which will order such arrangements as justice may require. It is unlawful for any person to willfully use 'stored water' for power or other purposes, if he is not entitled to its use by contract. It is also unlawful for any person to willfully interfere with the flow of any stored water except as is necessary in making reasonable use of such water under contract or decree or incident to the reasonable use of the natural flow in the exercise of rights as a riparian or littoral proprietor. The corporation regulates the storage and release of water from each reservoir in an attempt to minimize damages from floods and to promote the state's economic and industrial welfare. All property rights acquired by the corporation are exempt from all taxation, but the corporation will make payments to each town from which property rights were acquired equal to the current local tax rate on such property. (Johnson-Fla)
W69-09607

STATE DAMS, RESERVOIRS AND OTHER WATER CONSERVATION PROJECTS.
NH Rev Stat Ann secs 481:15-481:21 (1968).

Descriptors: *New Hampshire, *Administrative agencies, *Financing, *Governments, Local governments, Federal government, Legislation, Water law, Water policy, Legal aspects, Political aspects, Jurisdiction, Judicial proceedings, Investment, Interstate compacts, Public health, Water conservation, Flow control, Flowmeters, Gages.

By resolution, the board may authorize the issuance of bonds for the purpose of paying the cost of any such projects as it may sponsor. Such bonds are payable only from the revenue of the corporation and are not a debt of the state or any of its political subdivisions. In the event that the corporation defaults in payment of principal or interest on any of its bonds a receiver is appointed to gather necessary assets of the corporation and to make payments to bondholders. The governor with the advice and consent of the council may in the name of the state guarantee the principal and/or interest of any bonds issued by the corporation. In a similar manner the governor may enter into agreements or compacts with other New England states for the purpose of promoting public health and safety by conserving and regulating river flow, lessening flood damage and preventing pollution. The board cooperates with the United States Geological Survey in the establishment and maintenance of stream flow gauging stations for informational purposes. (Johnson-Fla)
W69-09608

COASTAL FISHERIES LAWS.
SC Code Ann secs 28-752 thru 28-761 (1962), as amended, (Supp 1968).

Descriptors: *South Carolina, *Fishing, *Regulation, *Public rights, Fish, Bays, Rivers, Streams, Marshes, Leases, Legislation, Legal aspects, Permits, Ownership of beds, Beds, Tidal waters, Saline water, Fish conservation, Saline water fish, Administrative agencies.

All waters and tideland bottoms of bays, rivers, creeks, and marshes in the state or within three miles of the coast shall remain as a common to the people for fishing. This does not include waters and bottoms previously conveyed by the state. Minimum sizes of various fish to be bought and sold are established. It is unlawful to use edible fish except for food or bait. The South Carolina Water Resources Commission may prescribe regulations and require permits for all fishing. No lessee of a bottom may mark his leased area with a sign without the Commission's authority. A natural-born citizen with a sheriff's operator certificate must be aboard any shrimping or fishing boats while in operation. The statute sets forth penalties for violations. These provisions do not apply to fish or fishing in fresh waters. (Breeze-Fla)
W69-09609

FOLEY V STATE (DAMAGES FOR ELIMINATION OF WATER SUPPLY).
299 NYS 2d 864-866 (1969).

Descriptors: *New York, *Water supply, *Irrigated land, *Appropriation, Irrigation, Damages, Land appraisal, Land classification, Land use, Condemnation value, Water costs, Water loss, Judicial decisions, Legal aspects, Water law, State governments, Water resources, Water sources, Property values, Land.

An appropriation of lands for highway purposes by the state eliminated the water supply source, derived from an old gravel pit, which served to irrigate some 39.74 acres of claimants' lands. The court of claims awarded damages to claimants, and the state appealed. In the lower court claimants' appraiser attributed $1000 to the loss of the water supply, but he also depreciated the value of the 39.74 acres by $25 per acre or $990 because of the loss of irrigation. The appraiser subsequently admitted that the $1000 item represented the estimated cost of a new water supply and that the $990 item only represented the factor of the loss of irrigation. The supreme court held that this cost-to-cure estimate was duplicative of the depreciation item and had to be deducted from the total award. (Carruthers-Fla)
W69-09610

MOREY V STATE (LIABILITY FOR HIGHWAY CHANGE OF GRADE).
297 NYS 2d 820-825 (NY App Div 1969).

Descriptors: *New York, *Surface runoff, *Artificial watercourses, *Highways, Highway relocation, Damages, Road construction, Grading, Appropriation, Channeling, Judicial decisions, Legislation, Overflow, Eminent domain.
Identifiers: *Negligence.

Damages were sought against the state for their negligent construction of a highway grade and the appropriation of claimant's land. The state re-constructed a highway in front of claimant's property. In changing the highway grade water and dirt was caused to flow onto claimant's property and into his building's basement. The lower court awarded $3500.00 based upon the de facto appropriation of claimant's land. The appellate division reversed the lower court indicating that claimant failed to state a cause of action. It was not proven that the reconstructed highway was negligently constructed. The court said that the state is not liable for damages for change of grade unless a specific statute permits recovery or artificial channeling promotes and directs the flow of water. No evidence showed such artificial channeling and the claim for appropriation was not accompanied with substantial proof. (Holt-Fla)
W69-09611

STATE AUTHORITIES EMINENT DOMAIN ACT.

SC Code Ann, secs 25-52, 25-53, 25-64 (1962).

Descriptors: *South Carolina, *Eminent domain, *Riparian rights, Real property, Condemnation value, Condemnation, Powerplants, Dams, Canals, Locks, Reservoirs, Reclamation, Swamps, Reforestation, Watersheds (Basins), Public benefits, Easements, Right-of-way, Legislation, Water rights, Damages, Hydroelectric plants.

All state authorities are empowered: to develop waterways of the state; to construct and maintain powerhouses, dams, canals, locks and reservoirs; to reclaim and drain swamps and flood lands; to improve health conditions; and to reforest water sheds shall have the right of eminent domain. The right of condemnation shall include the right to acquire land and water rights for the above purposes. Unless otherwise indicated all property taken will be subject to the owner's right of ingress and egress. If the state does not utilize condemned property for the above purposes within 5 years then the former owner shall have the right to repurchase and recover damages. All lands previously acquired for public purposes are subject to this chapter. Questions of compensation and special damages shall be determined in accordance with prevailing principles of law. Public electric utility property, however, shall be condemned only if it is to be incorporated with a proposed electric utility. (Holt-Fla)
W69-09612

KOCIAN V DEVITO (IMPLIED WARRANTY IN DIGGING WELL).
5 Conn Cir 399, 251 A2d 516-519 (1968).

Descriptors: *Connecticut, *Contracts, *Artesian wells, *Damages, Wells, Drilling, Negotiations, Legal aspects, Judicial decisions, Remedies, Consumptive use, Potable water, Water yield, Relative rights, Water quality, Water wells.

Plaintiff, an artesian well-drilling contractor, brought suit to recover the balance due for services and materials furnished to defendants in fulfilling three contracts to dig wells. The first two wells had produced water of either insufficient quantity or unsatisfactory quality. The third well produced water adequate in both quantity and quality. The trial court awarded damages less than the balance due because in its opinion, the parties seemed to contemplate some sort of negotiated settlement since the first two wells were unsatisfactory. Plaintiff appealed. The appellate court set aside the judgment and remanded with directions to award

to plaintiff the full balance due. Absent any guarantee by the driller, there is no implied warranty as to the quality or quantity of the water a well might produce. No evidence was presented to show plaintiff made any such guarantees. Even if the trial court accepted defendants' testimony that there was some vague mention of compromise, no actual discussion of compromise even took place and there was no agreement to reduce any prices due. (Gabrielson-Fla)
W69-09613

AALSBURG V CASHION (ALLOCATING ACCRETION AMONG RIPARIAN OWNERS).
165 NW 2nd 309-314 (Ct App Mich 1969).

Descriptors: *Michigan, *Boundaries (Property), *Accretion (Legal aspects), *Lake shores, Lakes, Shores, Riparian rights, Judicial decisions, Remedies, Legal aspects, Relative rights, Riparian land.

Plaintiffs, defendants, and third party defendants all owned adjoining lots fronting on a lake. Over the years the water level of the lake had gone down causing substantial accretion in front of these lots. The court was asked to determine the property lines between plaintiffs' and defendants' premises and between defendants' and the third party defendants' premises in relation to this accreted land. The trial court determined that up through 1942 the parties acquiesed in an extention of their side lot lines in setting common boundaries over accreted lands. The courts extended these boundaries from the 1942 shoreline to the imaginary center point of the lake. Plaintiff appealed. The appellate court ruled that there was insufficient evidence to permit a finding of acquiescence to extending the side lot lines to the 1942 shoreline. It ruled that the accretion could be properly allocated by finding the original side lot lines nearest the disputed property, extending those lines to the new shoreline and then in a straight line to the center of the lake, and by dividing the new shoreline within those lines in direct proportion to the front footage of the original lots. (Gabrielson-Fla)
W69-09614

FARNES V LANE (RIGHTS INCLUDED IN AN EASEMENT).
161 NW 2d 297-301 (Minn 1968).

Descriptors: *Minnesota, *Ri parian rights, *Easements, *Legal aspects, Judicial decisions, Right-of-way, Docks, Lake shores, Boating, Recreation, Land use, Severance, Relative rights, Access routes.

Plaintiff, a lake shore landowner, sought a declaration that defendant's right-of-way over the plaintiff's lakeshore property provided access to the lake only. Defendant claimed that his right-of-way entitled him to build a dock, moor a boat, and store equipment beside the dock. The Supreme Court of Minnesota sent the suit back for a new trial saying that new evidence was needed to decide plaintiff's and defendant's rights. The court said that an easement was not an estate in land, and that an estate in land was needed before there could be riparian rights. Thus the defendant was not a riparian owner since he had no estate in land just the easement. But the court stated that a grantee of an easement might have the right to install a dock, moor a boat, and store equipment near the dock if he could show that the circumstances of the grant of the easement contemplated these rights. The court suggested certain questions to be answered at the new trial to determine if the disputed rights were included in the easement. (Gadd-Fla)
W69-09615

THE STATE COLLEGE AND UNIVERSITY (POWER OF TRUSTEES TO ACQUIRE WATER RIGHTS).
NH Rev Stat Ann sec 187:8 (1964).

Descriptors: *New Hampshire, *Water utilization, *Water management (Applied), *Water works, Water conveyance, Water delivery, Domestic water, Industrial water, Water costs, Water sources, Water storage, Water supply, Water users, Sewers, Sewage disposal, Culverts, Conduits, Reservoirs, Surface drainage, Valves, Pumps, Gates, Legislation, Sanitary engineering.

The trustees shall have the following powers: (1) to acquire water by purchase or otherwise, construct reservoirs or water towers, erect pumping machinery, lay water mains and install gates, valves and hydrants; (2) to furnish and sell water for fire protection and industrial or domestic use to manufacturers, private corporations, and individuals; and (3) to construct sewers, culverts, conduits, and pipes with all necessary appliances for surface, under surface, and sewage drainage for the health and comfort and sanitary improvement of the town of Durham and its inhabitants. (Shevin-Fla)
W69-09616

MUNICIPAL AND COUNTY GOVERNMENT (WATER WORKS).
Vt Stat Ann tit 24, secs 3301-3316 (1959).

Descriptors: *Vermont, *Water supply, *Water works, *Water distribution (Applied), Legislation, Regulation, Pipelines, Artesian wells, Reservoirs, Water rights, Utilities, Equipment, Water control, Water rates, Aqueducts, Water contracts, Water allocation (Policy), Water utilization, Cities, Public utilities, Financing.

A municipal corporation is authorized to construct, maintain and repair artesian wells, reservoirs, pumps, engines and apparatus and to purchase or acquire, any artesian wells, ponds, springs, streams, watercourses, real estate, water rights, flowage rights, and easements necessary to provide a water supply. For these purposes, the corporation may enter upon and use any land to lay and repair aqueducts and pipes. Agreement as to just compensation may be entered into with respective property owners. In lieu of agrement, the matter may be set before a board constituted by the court of chancery, which shall assess and award just damages. Any person who uses the water provided by the municipal corporation shall be required to pay. Any person who diverts the water, bathes therein, injures or destroys any artesian well, dam, embankment, aqueduct, pipe reservoir, conduit, hydrant, structure pump or other machinery held, owned, or used by such municipal corporation shall be liable to said corporation for treble damages. Said municipal water corporation may issue bonds and may establish water rates, the moneys received to be used t o pay the interest upon the water bonds of the corporations. The money received from the operation of the municipal water department shall not be used for any other purpose until all such bonds have been paid. (Moulder-Fla)
W69-09617

MUNICIPAL AND COUNTY GOV'T (SEWAGE SYSTEM).
For primary bibliographic entry see Field 05G.
W69-09618

WATER SUPPLY FACILITIES; FLOOD CONTROL; WATER MANAGEMENT.
Ill Ann Stat ch 19, secs 1024-1 thru 1024-4, 1025-1 thru 1025-2, 1026-1 thru 1026-5 (Smith-Hurd Supp 1969).

Descriptors: *Illinois, *Flood control, *Water management, *Financing, Water supply, Construction costs, Waterworks, Administrative agencies, State governments, Cities, Local governments, Loans, Government finance, Project planning, Construction, Economic justification, Legislation, Planning, Water resources development, River basin development, Reservoirs, Dams.
Identifiers: Bond issues, Pure Waters Board, Matching funds, Government grant, Department of Public Health.

The Pure Waters Board is authorized to alloca state funds to municipalities and inter-municip and inter-state agencies for the construction a expansion of waterworks and water supply systen The Board shall consult with the Department Public Health and appropriate planning commi sions in determining the grant's necessity. A gra must be matched by local funds, and it cannot e ceed 30% of the project cost. An application for grant should include a report from the planni commission having jurisdiction in the project are The facilities for which the grant is made must me the requirements of the public health departmer The Board may make loans for these same pu poses. The Board may finance state flood contr projects which shall include the acquisition a construction of dams, reservoirs, drains, pump levees, flood walls, and related works and facilitie The board may finance land acquisition for t construction and development of state wat resources projects including dams, reservoirs, a other water management works and facilities f water supply. The Board may also finance sta participation in federal water resources projec Grants to finance planning programs may be giv to the River Basin Planning Commissions. (Gad Fla)
W69-09619

CANALS AND WATERWAYS.

Ill Ann Stat ch 19, secs 126a-128.3 (Smith-Hu 1963).

Descriptors: *Illinois, *Administrative agencie *Watershed management, *Flood protectio Water policy, Watersheds (Basins), Rivers, Flo Regulation, Planning, Surveys, Constructio Maintenance, Drainage, Costs, Contracts, Coo dination, Administration, Project planning, Co demnation, Easements, Powerplants, Surpl water, Floods, Flood control, Legislation, Leg aspects, Drainage districts, Surface waters.

The many adverse effects of unregulated river flo necessitate a state policy regulating flood and lo water flows. The Department of Public Works a Buildings may make surveys and plans, construc maintain, and operate all works to control flood improve drainage, and conserve low water flows any river or watershed. All necessary expenditur must be authorized by the legislature and confor to an approved report of survey sent to vario government officials containing stipulated dat The Department may implement the constructi by letting contracts or by direct employment. order to carry out these duties, the Departme may enter into agreements and acquire, throu any lawful means including condemnation, a lands and easements necessary. The Departme may operate powerplants to utilize surplus wate In a flood emergency the Department may expe funds for flood relief in conformity with a report survey; or if no approved report of survey exists, f the restoration of the flood control works. It is sta policy to implement watershed protection for flo control and other benefits. The state Departme of Agriculture may enter into agreements f planning and engineering watershed improv ments. (Breeze-Fla)
W69-09620

CHICAGO REGIONAL PORT DISTRICT.
Ill Ann Stat ch 19, secs 155a, 156 (Smith-Hu 1963).

Descriptors: *Illinois, *Harbors, *Port authoriti *Navigable waters, Piers, Docks, Structures, Pe mits, Legislation, Regulation, Shores, Administr tive agencies, Landfills, Beds, Beds under wat Land use, Construction, Basins, Planning, Navig tion, Obstruction to flow, Boats, Ships, Leg aspects.

Changes and modifications in existing harbor pla within the area of the Chicago Regional Port D trict recommended by the District or developme plans for the port facilities adopted by the Distri

ust be approved by the Department of Public 'orks and Buildings. Such approval shall be con- usive evidence of compliance with the require- ents of this act. No such changes shall be ap- oved which reduce the area of Lake Calumet arbor to less than 500 acres or a basin thereof to ss than 300 acres. The deed made by the city of hicago to the Port District of land in and near ake Calumet is hereby confirmed excepting such nds as fall within Calumet Harbor. If any future odifications change the area of said Harbor, the istrict shall have all the right, title, and interest to ch lands above excepted as thereafter cease to rm part of the harbor. The Port District has wer to issue permits for the erection of any struc- re within 40 feet of navigable waters within the istrict and for the deposit of any material in said aters, to remove obstructions, and to establish ck, shore, and harbor lines. (Kahle-Fla)
69-09621

AKING DRAINS, ROADS OR RAILROADS.
r primary bibliographic entry see Field 05G.
69-09622

EGULATING AND MEASURING WATER-OWER.
Ann Stat ch 92, sec 12 (Smith-Hurd 1966).

escriptors: *Illinois, *Hydroelectric power, Equitable apportionment, *Contracts, Dams, egulation, Water measurement, Water delivery, 'eirs, Water allocation (Policy), Legislation, egal aspects, Water control, Water supply, references (Water rights), Water contracts, 'ater distribution (Applied), Water utilization, In- rumentation, Hydroelectric plants.

'here different persons have the right to use the ater or water power of a river dam, the dam wner and any such person may fix some fair and easonable plan of measuring and delivering the ater or water power. This regulation, once ecorded, is binding on all entitled to use the water r water power provided the regulations apportion ach person his just share fairly. (Breeze-Fla)
69-09623

OUNCIL V CLARK (BOUNDARY LINE ISPUTE).
41 SW 2d 472-474 (Ark 1969).

escriptors: *Arkansas, *Boundaries (Property), Boundary disputes, *Streams, Legal aspects, Judi- al decisions, Water rights, Non-navigable waters, and, Land tenure, Land resources, R elative ghts, Barriers, Natural streams, Construction sts, Gates, Drainage, Conservation.
lentifiers: *Fences, Thread of the creek.

ppellants conveyed a portion of their property to ie Millard Wright, appellee's predecessor in title. ortly after the original conveyance a fence was nstructed along the south bank of a creek which n between the two tracts of land. Appellants con- nded this fence was meant to be a boundary di- der. Wright denied this, claiming that appellants ere to share the cost of construction and that a ater gate was to be built across the creek. In 1959, right conveyed the land to the appellees reserv- g one-half the mineral rights for himself. estimony showed that appellants had cleared the rth bank but that nothing had been done to the uth bank. The trial court found the fence was one convenience and not a boundary fence. The undary line was determined to be the thread of e creek and this appeal followed. The supreme urt affirmed, holding that the under the deed title tended to the middle of the creek. The court ated that the burden of proof of showing that a fferent boundary line than that described in t he ed was intended was on the appellant and that his rden was not met. The court determined that the nce was built as close to the natural barrier as ssible and had not become a boundary line by quiescence. The court also discounted appel- lant's claim that he had acquired the property by adverse possession. (Shevin-Fla)
W69-09624

BRADY V SPRINGDALE (CONDEMNATION ACTION FOR DESTRUCTION OF SPRINGS).
For primary bibliographic entry see Field 05G.
W69-09625

CONSERVATION DISTRICT ACT.
For primary bibliographic entry see Field 03D.
W69-09626

CONTRACTS BY CITIES WITH UNITED STATES REGARDING FLOOD CONTROL PROJECTS.

Ill Ann Stat ch 24, secs 866h1, 866h2, 866h3 (Smith-Hurd 1962).

Descriptors: *Illinois, *United States, *Contracts, *Flood control, Legislation, Project planning, Financing, Cities, Regulation, Right-of-way, Bridges, Pollution abatement, Damages, Flood protection, Construction, Cost sharing, Operation and maintenance, Channels, Federal Government, Local governments, Legal aspects.

Any city, village or incorporated town may enter into contracts or agreements with the United States that such city, village or town will, with reference to any flood control project constructed or to be constructed by the United States and so located as to furnish protection to the city, village or incorporated town from floods: (1) provide the land necessary for the project; (2) contribute part of the cost of the project; (3) imdemnify the United States from claims for damages arising from such project; (4) maintain and operate all the works after completion of the project; (5) establish and enforce flood channel limits for the protection of any flood channel; (6) prevent dumping of waste material or the creation of fills within any flood channel limits; (7) regulate the construction of bridges crossing any waterway; and (8) restrict further residential development in the area protected. (Heckerling-Fla)
W69-09627

INTERSTATE DRAINAGE DISTRICTS.
Iowa Code Ann secs 467.1 to 467.6 (1949).

Descriptors: *Iowa, *Interstate compacts, *Equitable apportionment, *Drainage districts, Controlled drainage, Governments, State governments, Drainage systems, Cost allocation, Construction costs, Cost sharing, Legislation, Interstate, Boundaries (Property), Administrative agencies, Contracts, Bids, Assessments.
Identifiers: *Interstate drainage districts.

When proceedings for drainage of land bordering the state line are had, and total costs are ascertained, authorities of this state may order a hearing to establish an interstate drainage district upon report of the engineer in charge that such proceedings should be had jointly with an adjoining state. An agreement shall be reached between the states as to equitable allocation of costs among the property owners of each state. Unless construction on each side of the state line can progress independently, no contract shall be let without approval of both states, but the contracts for construction within this state are distinct from contracts of the other state. No contract shall be let until final determination of the improvement and costs. (Harris-Fla)
W69-09628

DRAINAGE DISTRICTS IN CONNECTION WITH UNITED STATES LEVEES.

Iowa Code Ann secs 466.1 to 466.8 (1949).

Descriptors: *Iowa, *Levees, *Cost sharing, *United States, Financing, Navigable waters, Navigable rivers, Construction, Maintenance costs, Drainage districts, Right-of-way, Public health, Drainage systems, Administrative agencies, Construction costs, Assessments legislation, Boundaries (Property).
Identifiers: State boundaries.

Where the United States has built or shall build a levee on a navigable stream forming an Iowa boundary, the county board of supervisors shall have the power to aid in procurring the right of way for and maintaining said levee and providing an internal drainage system to complement the levee construction. Improvements shall be presumed to be conducive to public health. Any United States levee may be considered by the board as a part of the plan for any levee or drainage district and such board may agree with the United States to share in the cost of procurring the right of way and maintenance of such levee. The engineer shall set forth the cost of constructing and maintaining the cooperative levee. If a drainage district is established, all costs incurred under this chapter shall be assessed and collected from lands lying within such district. The annual amount collected for maintenance shall not exceed 12 1/2 mills per dollar of the assessed valuation unless the same is petitioned for in the manner required for the inauguration of new work. (Holt-Fla)
W69-09629

TRUSTEE MANAGEMENT OF DRAINAGE OR LEVEE DISTRICTS.

Iowa Code Ann secs 462.1 to 462.41 (1949), as amended, (Supp 1969).

Descriptors: *Iowa, *Levees, *Local governments, *Drainage districts, Political aspects, Condemnation, Right-of-way, Eminent domain, Ditches, Drainage, Multiple-purpose projects, Controlled drainage, Legislation, Leases, Settling basins, Mississippi River, Legal aspects, Administrative agencies, Water management (Applied).

Elected trustees are authorized to exercise the power formerly conferred on the boards of supervisors for the control, management, and supervision of drainage and levee districts. The authority of such trustees includes the power to acquire lands by conveyance, lease, or condemnation for rights-of-way for levees, ditches, and settling basins and to annex lands to the district. Specific provisions dictate the manner of election of trustees, the qualifications of trustees, the levee or drainage districts which are entitled to trustee control, how a district can petition for an election of trustees, and how a trustee district can petition to be placed back under the management of a board of supervisors. (Keith-Fla)
W69-09630

WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W69-09631

LEVEE AND DRAINAGE DISTRICTS.
Iowa Code Ann, secs 455.45 to 455.51 (1949), as amended, (Supp 1969).

Descriptors: *Iowa, *Drainage districts, *Levees, Construction, Contracts, Administrative agencies, United States, Damages, Erosion, Railroads, Highways, Benefits, Assessments, Cost allocation, Comparative benefits, Project benefits, Equitable apportionment, Legislation, Local governments, Appraisals.
Identifiers: *Plans, *Improvements.

When a county board of supervisors establishes a levee or drainage district or accepts an improvement or federal plan, such board shall appoint a commission to assess benefits to land within such district. Only present benefits from the present im-

provements or plans are assessed. The benefit assessment from main ditches is reported separately from that of lateral ditches. The commissioners will file a report giving names of and benefits to property owners, railroads, highways, and state lands, the respective assessments for main ditches, lateral levees, and pumping stations, and total assessments. (Darragh-Fla)
W69-09632

DUTY OF ROAD OFFICERS.

Iowa Code Ann sec 319.7 (1949).

Descriptors: *Iowa, *Highways, *Repairing, *Maintenance, Open channels, Ditches, Public rights, Legislation.

All officers responsible for the care of public highways outside cities and towns shall remove all open ditches, water breaks and like obstructions from travelled portions of the highways within their jurisdiction. (Harris-Fla)
W69-09633

BRIDGES OVER STATE BOUNDARY LINE STREAMS.
Iowa Code Ann secs 309.84-309.92 (1949).

Descriptors: *Iowa, *Bridge construction, *Cost sharing, *Interstate rivers, Interstate compacts, Administrative agencies, Cost allocation, Boundaries (Property), Streams, State governments, Cities, Public utilities, Public rights, Taxes, Legislation, Costs, Legal aspects, Local governments.

Bridges on county line roads may by agreement be located, constructed, and maintained by one county to insure a proper site and to avoid unnecessary expense. Work and expense shall be shared by the counties. On petition of 10% of the legal voters of a county bordering a stream which forms a state boundary, an election may be had to determine whether the public favors construction of a foot or wagon bridge across said stream. The question shall be submitted at general election after public notice. If a majority of the voters favor a bridge, the board may agree with an adjoining state, or any municipal division thereof, as to allocation of cost and maintenance. The board may tax property in the county and issue bonds to finance the bridge. Such bridge may be used by public utilities under conditions agreed upon by the constructing and maintaining authorities, but no such use shall interfere with the public use. (Harris-Fla)
W69-09634

CONSTRUCTION AND MAINTENANCE OF BRIDGES AND CULVERTS.
Iowa Code Ann secs 309.67 - 309.83 (1949), as amended, (Supp 1969).

Descriptors: *Bridge construction, *Culverts, *Maintenance, *Iowa, Bridges, Administrative agencies, State governments, Federal government, Construction costs, Cost sharing, Maintenance costs, Repairing, Sluices, Design standards, Structures, Cities, Surface drainage, Bridge design, Cooperation, Legal aspects, Local governments.

The county board of supervisors and the county engineer are responsible for keeping bridges and culverts of the secondary road system open. Boards of supervisors of adjoining counties are required to divide the responsibility and cost of construction and maintenance of bridges and culverts found along county boundary lines. Board plans for the construction of bridges are subject to the approval of the state highway commission. If the intracounty boards fail to adequately cooperate, the state highway commission may render a binding allocation of responsibility. If the intracounty boards fail to comply with the commission's decision, the commission may proceed with the necessary construction or maintenance and bill costs to the respective counties. Similar provisions relate to bridges and culverts located along city-county boundaries. The terms 'culvert' and 'bridge' are defined, and maximum amounts for construction of intracounty and intercounty bridges are set. State specifications must be adhered to in bridge construction. (Keith-Fla)
W69-09635

DRAINAGE OF COAL AND MINERAL LANDS AND MINES.
For primary bibliographic entry see Field 05G.
W69-09636

HYDROELECTRIC GENERATING PLANTS AND PROJECTS.
Iowa Code Ann secs 469A.1 to 469A.7 (1949).

Descriptors: *Iowa, *Hydroelectric project licensing, *Hydroelectric plants, *Public utilities, Facilities, Regulation, Administrative agencies, Control, Water policy, State governments, Investigations, Financial feasibility, Legislation, Legal aspects, Operation and maintenance, Construction.
Identifiers: *Licensing, Penalties (Criminal).

A certificate of convenience and necessity from the executive council of Iowa must be obtained for any person or other entity to engage in the construction, maintenance, or operation of a hydroelectric generating project. Such certificates shall issue only after a public hearing, after the council is satisfied that public convenience will be served, and after the applicant is financially able to complete the project under the council's terms. The council shall regulate hydroelectric projects under this act and may investigate projects and revoke certificates. Violations of this act are misdemeanors, with each day's continued violation constituting a separate offense. (Harris-Fla)
W69-09637

WATER-POWER IMPROVEMENTS.

Iowa Code Ann secs 470.1 to 470.6 (1949).

Descriptors: *Iowa, *Hydroelectric power, *Water utilization, *Facilities, Relative rights, Land tenure, Compensation, Eminent domain, Condemnation, Canals, Highways, Construction, Public rights, Navigation, Legislation, Pipes, Conduits, Financing, State governments, Water works, Public utilities.

Any person or corporation formed to utilize and improve water power in this state, may take and hold real estate, and such products of the land as are necessary for the location and construction of canals, conduits, and other improvements. Compensation shall be made to the owner for such taking. Such person or corporation may alter any road in order that its pipes may pass over, under or along such road, and may also construct pipes over or under any railway, stream or canal, but may not interfere with navigation thereon. Such person or corporation may pass over, occupy and enjoy lands owned by the public, making compensation therefor. In addition, such corporation shall have power to finance and convey as prescribed by this chapter. Within two years of date of acquisition of the powers in this chapter, the person or corporation shall supply capital and actually commence its work, with such water works to be completed within five years. The rights and powers conferred herein shall at all times be subject to legislative control. (Harris-Fla)
W69-09638

ADMINISTRATION - HIGHWAYS - DRAINAGE.
Iowa Code Ann sec 314.7 (Supp 1 969).

Descriptors: *Iowa, *Highway effects, *Surface drainage, *Natural flow, Obstruction to flow, Relative rights, Channels, Surface runoff, Legislation, Land tenure, Easements, Public rights, Tile drains.

Officers, employees, and contractors in charge
improvement or maintenance on highways shall
obstruct tile drains and shall not interfere with
natural drainage of surface waters to the injury
adjoining landowners. It is the duty of such perso
to drain surface water from the public road in
natural channel. In order to do this, they may en
adjoining lands and remove obstructions to
natural drainage. (Harris-Fla)
W69-09639

FEDERAL WATER RESOURCES PROJECTS.
Iowa Code Ann secs 306.33, 306.34 (Supp 1969)

Descriptors: *Iowa, *Highways, *Easemen
*Flooding, United States, State jurisdictio
Federal Government, Administrative agenci
Contracts, Right-of-way, Surface waters, Legis
tion.
Identifiers: *Federal Water Resources Projects.

The board or commission which has control and
risdiction over highways affected by federal wa
resources projects may sell, exchange or convey
the United States a perpetual easement to flo
and submerge the highways. Where such easeme
affect primary roads, state parks or institutio
roads, such conveyances shall be in writing a
signed as provided by this chapter. Where co
veyances are made in connection with seconda
roads, they shall also be in writing and signed
provided. (Harris-Fla)
W69-09640

FISH AND GAME CONSERVATION.

Iowa Code Ann secs 109.1-109.13 (1949).

Descriptors: *Iowa, *Fish management, *Regu
tion, *Administrative agencies, Fish stockin
Lakes, Streams, Legislation, Mussels, Cla
Frogs, Spawning, Fish hatcheries, Fish migratio
Overflow, Conservation, Public lands, Wa
utilization, Fish conservation.

The title to all fish, mussels, clams and frogs in a
public waters or waters stocked from overfl
therefrom is in the state of Iowa. Title shall rema
in the state for purposes of regulating the taking
possession of such aquatic life. The state conser
tion director is empowered to establish and cont
the state fish hatcheries for the purpose of stocki
the waters of the state. Once the state conservat
commission has declared a stream or lake a pub
park, the conservation director may establish
state game refuge thereon. The commission sh
be empowered to regulate game manageme
areas. The director shall have power to set off p
tected spawning areas. The director must report
the governor all contracts let for the taking of s
fish from state waters. Money derived from su
contracts shall inure to the fish and game prote
tion fund. All fish taken unlawfully shall be seize
(Holt-Fla)
W69-09641

FISH AND GAME CONSERVATION.
Iowa Code Ann secs 109.14-109.37 (1949),
amended, (Supp 1969).

Descriptors: *Iowa, *Fish, *Fish manageme
*Dams, Dam construction, Fish harvest, Fi
reproduction, Fresh-water fish, Frogs, Gastropo
Fish conservation, Wildlife conservation, Admin
trative agencies, Regulation, Wildlife, Wildl
management, Barriers, Fish barriers, Fish passag
River regulation, Water control, Water leve
Water loss, Pumping plants, Legislation, Leg
aspects.
Identifiers: *Dam destruction, Pumping statio
Fishways, Penalties (Criminal).

It is unlawful to obstruct the free passage of fish
the placing of a dam or any other structure in t
water unless written permission is obtained fr
the State Conservation Director. Written perm
sion is likewise required to operate a pumping s

n or plant which is not provided with screens to event fish from entering the machinery. It is unwful to alter a dam in any way so as to lower the ter level unless approval is obtained from the atural Resources Council. The Conservation rector is given authority to remove fish from blic waters for certain enumerated purposes prode he does so with minimum injury to the lake or eam. Specific provisions regulate the taking, le, possession, and transportation of fish and cern other wildlife, and set forth penalties for violan of these provisions. (Keith-Fla)
69-09642

IPORTING FISH.

wa Code Ann sec 109.47 (1949).

escriptors: *Iowa, *Fish management, *Fish disses, Fish control agents, Permits, Regulation, Adnistrative agencies, Legislation, Legal aspects, ildlife conservation, Fish pathology, Fish conservtion.

nless a permit is procured from the fish and game mmission, it shall be unlawful to place into any land or boundary waters of Iowa any non-native h or spawn. Permits will be granted only if such h are found to be free from disease and beneficial the native wildlife and people of the state. (Holta)
69-09643

ITERSTATE BRIDGES (ADDITIONAL ACT).

wa Code Ann secs 383.1 - 383.30 (1949), as nended, (Supp 1969), sec 383.31 (Supp 1969).

escriptors: *Iowa, *Cities, *Bridges, *Condemnaon, Procurement, Administrative costs, Eminent omain, Cost repayment, Leases, Bridge construcon, Bridge design, Construction costs, Cost alloion, Contract administration, Maintenance, Inrstate rivers, Interstate commissions, Interstate mpacts, Public utilities.
entifiers: *Interstate bridges.

ties are authorized to acquire by purchase, conmnation, lease, sublease, or otherwise any existg bridge. Any city is further authorized to conruct, repair, maintain, reconstruct, enlarge, place, and operate any such bridge as a toll or ee bridge. These powers may be exercised by the y independently or in cooperation with another olitical unit in or out of the state when such politil unit has an interest because the bridge involved interstate. Bridges so acquired may be conveyed leased by the city as a public utility. Specific ocedures are provided for the acquisition of idges by purchase or condemnation. The ethods of financing by bond issue and taxation e also specifically provided for. Tolls must be harged if necessary for the protection of bondhollers. Cities are empowered to create bridge comissions to carry out the foregoing provisions, and e duties and powers of such commissions are enuerated. Such commissions may be jointly created th other political units in appropriate cases. amage to property or property rights caused by ercise of the foregoing powers is to be reimrsed to the damaged party. (Keith-Fla)
69-09644

XERCISE OF EMINENT DOMAIN BY CITIES OR CONSTRUCTION OF WATERWORKS ND WATER PIPE LINES.

rk Stat Ann secs 35-902, 35-913, 35-914 (1962).

escriptors: *Arkansas, *Cities, *Eminent domain, Water works, Legislation, State governments, ondemnation, Legal aspects, Docks, Levees, irks, Water pollution, Dams, Lakes, Compensaon, Condemnation value, Administrative agenes, Public utilities, Right-of-way, Easements, onstruction, Maintenance, Reservoir construcon, Dam construction, High water mark, pelines, Water supply.
Identifiers: *Water pipelines, Cemetery , Impounding lake.

Cities may exercise the power of eminent domain for the construction of wharves, levees, parks, squares, market places, or other lawful purposes. The term 'or other lawful purposes' is defined to include all or any part of a waterworks system. The power so granted may be exercised out of the county in which the city is located. Specific provision is made for the manner in which a city may condemn cemetery, public utility, county, and state property and for the manner in which these entities are to be compensated or made whole by the condemning city. Property may be condemned for the construction and maintenance of water pipe lines, and the manner in which the city is to proceed in such condemnation is set forth; similar provisions apply to condemnation of property for impounding lakes. (Keith-Fla)
W69-09645

PUBLIC HEALTH AND SAFETY.
For primary bibliographic entry see Field 05G.
W69-09646

HIGHWAYS, BRIDGES AND FERRIES.

SC Code Ann secs 33-812, 33-813, 33-814.1 (1962).

Descriptors: *South Carolina, *Highways, *Drainage, *Right-of-way, Transportation, Road construction, Ditches, Streams, Natural flow doctrine, Pipes, Eminent domain, Surveys, Mapping, Measurement, Access routes, Easements, Real property, Land tenure, Cities, Local governments, Drains, Streamflow, Legislation, Legal aspects.
Identifiers: Overseer.

It shall be a misdemeanor to interfere with a surveyor employed by a county or the line laid out by him. Any county may have the overseer construct footpaths or bridges over streams and along the highways of the county. Any county with a city of more than 86,000 people may accept rights-of-way over and across private property for constructing drainage ditches to drain roads and streets. The direction of flow of natural streams shall not be changed. The grantor of the right-of-way shall furnish all necessary pipes for the drain. The property owner shall give the necessary right-of-way to the final disposition point of the water and shall hold the county harmless for any damage to his land. (Helwig-Fla)
W69-09647

ATLANTIC STATES MARINE FISHERIES COMMISSION.

SC Code Ann sec 28-201 thru 28-205 (1962).

Descriptors: *Fish management, *South Carolina, *Atlantic Ocean, *Interstate compacts, Administrative agencies, Legislation, Regulation, Interstate commissions, Fish conservation, Fishing, Fisheries, Commerical fishing, Sport fishing, Marine fish, Marine fisheries.
Identifiers: *Atlantic States Marine Fisheries Compact.

Pursuant to the Atlantic States Marine Fisheries Compact, three commissioners shall be appointed from this state. The first commissioner shall be the Director of the Division of Commercial Fisheries. The second commissioner shall be a legislator and member of the Commission on Interstate Cooperation designated by that commission. The Governor, with advice and consent of the Senate, shall appoint a citizen with knowledge of the marine fisheries problems as the third commissioner for a term of three years. The commissioners shall have all the powers provided for in the compact and all necessary incidental powers to carry out the compact. All officers of the state shall cooperate with the Commission and furnish it with information and data possessed by them. The Commission shall report on receipts and disbursements annually to the governor and general assembly, set forth the transactions carried on by it, and make recommendations for any action deemed advisable. (Kahle-Fla)
W69-09687

PROTECTION OF FISH (ESTABLISHING FISH HATCHERIES).

SC Code Ann secs 28-693, 28-710, 28-711, 28-712, 28-717, 18-718 (1962).

Descriptors: *South Carolina, *Fish conservation, *Fish hatcheries, *Regulation, Fish, Ponds, Lakes, Rivers, Streams, State governments, Fish management, Condemnation, Eminent domain, Legislation, Legal aspects, Riparian rights, Public rights, Administrative agencies, Water resources development, Cost sharing, Federal project policy, Permits, Financing.
Identifiers: *Fish restoration projects, *Fish sanctuaries.

The owner of a private pond may draw the pond and dispose of the fish by sale at the site in the presence of a Division of Game representative. The state assents to Public Law No. 681, 81st Congress for aid to fish restoration projects. The South Carolina Wildlife Resources Department shall establish such fish restoration projects and fund them from the sale of resident fishing licenses. The South Carolina Wildlife Resources Commission may acquire land by condemnation if necessary to establish fish hatcheries and nurseries. The Commission may also lease or purchase land for the United States Fish and Wildlife Services to establish fish hatcheries. The Director of the Division of Game may designate any place on a river or stream as a fish sanctuary upon approval of the county legislative delegation. The Director may also set apart a lake or pond as a fish sanctuary upon agreement with the landowner. (Breeze-Fla)
W69-09710

WATER POLITICS IN MISSISSIPPI: A COMPARATIVE ANALYSIS OF TWO WATER RESOURCE DEVELOPMENT ORGANIZATIONS,
Mississippi State Univ., State College. Social Science Research Center.
A. R. Jones, and H. M. McLeskey.
Completion Report, Mississippi Water Resources Research Institute, July 1969. 34 p, 2 tab, 2 fig, 6 ref. OWRR Project A-031-MISS.

Descriptors: *Social aspects, *Organizations, Promotion, *Political aspects, Institutions, State governments, Water resources development.

Activities of two large-scale water resource promotional organizations are compared to determine strategies used by each to secure project funding. Activities are analyzed in terms of the history of each organization and its relationships to local publics, the Corps of Engineers, Bureau of the Budget, and Congress. Data were derived from interviews with the Administrators of the two agencies, the Tennessee-Tombigbee Waterway Development Authority (TTWDA), and the Pat Harrison Waterway District (PHWD), and review of organizational records. The findings were: (1) The two organizations are different in purpose and have different images; (2) TTWDA has had to 'sell' its project in view of a marginal economic classification while PHWD's efforts have been supported by relatively high benefit-cost ratios and a comprehensive development plan; (3) TTWDA has created a base of organized support (decentralized representation) in contrast to the centralized pattern of agency representation characteristic of PHWD; (4) In the context of their past histories and current relationships to Congress both organizations are 'successful' in that Congressional authorization and appropriations have, to some degree, been achieved for their respective projects.
W69-09722

STRATEGIC CONSIDERATIONS IN ATTAINING WATER RESOURCES PLANNING GOALS, Wisconsin Univ., Madison.
For primary bibliographic entry see Field 06B.
W69-09771

GAME AND FISH COMMISSION.

Ark Stat Ann secs 47-101 thru 47-134 (1964).

Descriptors: *Arkansas, *Conservation, *Fish conservation, *Administrative agencies, Legislation, State governments, Federal government, Financing, Fish management, Regulation, Permits, Water conservation, Fish harvest, Fish farming.

The control, management, restoration, conservation and regulation of fish is vested in the Arkansas State Game and Fish Commission. The Commission has the exclusive power and authority to issue licenses and permits, provide catch limits, establish fishing zones and seasons, and provide penalties for violations. The Commission shall adopt ways to conserve and propagate fish, and to regulate fish propagation by private individuals. The Commission is authorized to cooperate with agencies of the United States government to further conservation and protection of wildlife. Game wardens and other employees shall be appointed to enforce Commission regulations. The Commission may apply to the state land commission for the use of state lands suitable for fish and game refuges. The fees or funds arising from the Commission activities shall be used to further the conservation goals of the Commission. The state of Arkansas assents to the congressional act designed to aid the states with fish restoration and management. (Darragh-Fla)
W69-09775

FISHING AND HUNTING LICENSES.
Ark Stat Ann secs 47-208 thru 47-210, 47-213, 47-215, 47-217 thru 47-223 (1964), as amended, (Supp 1967).

Descriptors: *Arkansas, *Permits, *Fish management, *Wildlife management, Legislation, Legal aspects, Regulation, Fishing, Fish conservation, Administration, Administrative agencies, Wildlife conservation.
Identifiers: *Penalties (Criminal), *Fishing permits.

A fishing license is required if fish are to be taken by specified methods. Certain classes of persons require special licenses, certain persons are exempt, and certain persons cannot obtain a license. Licenses are of no effect during closed seasons. Criminal penalties are set forth for non-compliance with any of the foregoing provisions. The cost of each type of license is set forth and it is provided that a specified portion of all license fees will go to the Arkansas Game and Fish Commission. Similar provisions apply to the taking of game. (Keith-Fla)
W69-09776

TITLE TO LAND ABOVE THE HIGH WATER MARK.

Ark Stat Ann secs 10-201 thru 10-207 (1956).

Descriptors: *Arkansas, *Alluvium, *Accretion (Legal aspects), *Riparian land, Legislation, Legal aspects, Riparian rights, High water mark, Navigable waters, Non-navigable waters, Beds, Streams, Lakes, Surveys, Boundaries (Property), Ownership of beds, Relative rights, Channels.
Identifiers: *Ownership of alluvium.

The state must institute suits to recover any forgotten, lost, or other outstanding public interest in property or to quiet title to any lands to which the state may claim title. All land which has formed or may hereafter form in the navigable waters of the state and within the original boundaries of a former owner of land along such stream shall belong to such former owner or his successors in interest. Title to all lands which have formed or may hereafter form in the beds of non-navigable lakes or in abandoned river channels or beds, whether or not still navigable, which are above ordinary high-water mark will vest in the riparian owners of said lands. The commissioner of state lands issues deeds to such lands upon application by such riparian owners after a proper survey has been made. (Keith-Fla)
W69-09777

CUTTING TIMBER ON SWAMPS AND OVERFLOWED LANDS.
For primary bibliographic entry see Field 04A.
W69-09778

SALE OF SWAMP AND OVERFLOWED LANDS.
For primary bibliographic entry see Field 04A.
W69-09779

AUTHORITY OF CITIES TO OPERATE HARBORS AND PORTS; CREATION OF PORT AUTHORITIES.
For primary bibliographic entry see Field 04A.
W69-09780

IRRIGATION COMPANIES.
For primary bibliographic entry see Field 03F.
W69-09781

DAMAGE TO WATER, FLOOD CONTROL STRUCTURES, OR FISH.
For primary bibliographic entry see Field 05G.
W69-09782

HIGHWAYS.
For primary bibliographic entry see Field 04A.
W69-09783

INTERSTATE COMPACTS.

Ark Stat Ann secs 76-2101 thru 76-2104 (1958).

Descriptors: *Arkansas, *Interstate compacts, *Interstate commissions, *Bridges, Bridge construction, Legislation, Legal aspects, Mississippi, Mississippi River, Operation and maintenance, Construction, Planning, Eminent domain, Easements, Surveys, Administrative agencies.
Identifiers: Ferries, Property acquisition.

A proposal is made by the state of Arkansas that it enter into an interstate compact with Mississippi for the formation of an Arkansas-Mississippi Bridge Commission. The purpose of such a commission would be the planning, construction, maintenance, and operation of a bridge at a specified location over the Mississippi River. The Commission would have power to: purchase and operate all ferries across the Mississippi River within twenty-five miles of the bridge site; contract; sue and be sued; acquire and dispose of property; and exercise the power of eminent domain. Specifically provided for are the financing of the bridge, rates of tolls, record keeping, and administration of the Commission. (Keith-Fla)
W69-09784

FISHING REGULATIONS.

Ark Stat Ann secs 47-401 thru 47-420 (1964).

Descriptors: *Arkansas, *Fish conservation, *Fishing, Fish management, Legislation, Legal aspects, Size, Baits, Bait traps, Trapping, Bass, Fresh-water fish, Minnows, Regulation, Commercial fishing, Permits.
Identifiers: *Penalties (Criminal).

Specific provisions regulate the manner in which fish may be taken, what baits may be used, and the time, size, and number of fish which may be take The licensing of commercial bait dealers is pr vided for. Criminal penalties are set for violatio of each of the foregoing provisions. (Keith-Fla)
W69-09785

MISCELLANEOUS PROVISIONS RELATIN TO HUNTING AND FISHING.

Ark Stat Ann secs 47-501 thru 47-524, 47-532 th 47-534 (1964).

Descriptors: *Arkansas, *Fish conservatio *Commercial fishing, Legislation, Administrati agencies, Fish management, Water levels, Fishin Sport fish, Dams, Sluices, Regulation, Permits, Fi harvest, Fish passages, Fish guiding, Fish barrie Water utilization.

All fish not in private ponds are property of th state and the catching of these fish is a privileg Any violation of regulations pertaining to fishi will subject all equipment used for such catching seizure. While fish caught outside the state may brought into the state, certain varieties if caug within the state may not be shipped out of the sta without a permit. Commercial fishing is regulate as to size and type of fish. The sale of game fish prohibited. Any person maintaining a dam acro any stream must either keep said stream suf ciently open to allow passage of fish through th dam or construct a sluice over or around the da It is unlawful to lower any natural water stage to point which endangers fish. All intake pipes waterbodies must be screened to prevent entry fish. (Darragh-Fla)
W69-09786

MUSSELS.
Ark Stat Ann secs 47-601 thru 47-604 (9164).

Descriptors: *Arkansas, *Mussels, *Shellfis *Commercial shellfish, Legislation, Aquat animals, Administrative agencies, Invertebrate Water conservation, Equipment, Harvesting, W dlife management, Fishing gear, Permits, Leg aspects, Regulation.
Identifiers: *Mussel harvesting.

Persons licensed under this act may use only o boat in taking mussels for commercial purpose An additional boat may only be used for towi purposes. The kind and number of tackle to used in taking mussels for commercial purposes specified. Size limits are established for the sal purchase and possession of various mussels shells and penalties provided for violations. Licen requirements are set forth for the takers of musse the buyers of shells, and for boats used in dealing fresh-water mussel shells. All holders of a sh buyer's license are required to make an annual r port to the state Game and Fish Commission as the amount, price and source of mussels boug The state Game and Fish Commission shall enfor the law relating to mussels and may prescribe are from which mussels may not be taken and the tim period of such restriction. For purposes of this ac mussel, crowfoot bar, dredge, commercial pu poses and rig are defined. (Marsee-Fla)
W69-09787

CROSSING BY STATE HIGHWAYS O WATERCOURSES.
For primary bibliographic entry see Field 04A.
W69-09788

RECREATIONAL ACTIVITIES NEAR WATE SUPPLY.
For primary bibliographic entry see Field 05G.
W69-09789

STAUFFACHER V CITY OF SUN PRAIRI (RIGHTS TO A DRAINAGE EASEMENT).
For primary bibliographic entry see Field 04A.
W69-09790

RBECK VILLAGE JOINT VENTURE V NTGOMERY COUNTY COUNCIL (ZONING WATERSHED MANAGEMENT).
primary bibliographic entry see Field 05G.
-09791

ER FRONT IMPROVEMENT COMMIS-N.
primary bibliographic entry see Field 04A.
-09792

NSTITUTIONAL ISSUES IN GAS AND OIL: ANALOGY,
vin Pitch.
ssiz Center for Water Studies Research Report, 1, No 2, 1968. 17 p, 49 ref.

criptors: *Foreign countries, *Governments, ter resources development, *Regulation, l aspects, Oil, Natural gas, Legislation, Conation, Pipelines, Water allocation (Policy), er pollution, Export, Proration, Political cts, Marketing, Water utilization, Natural urces, Political constraints, Interstate urces development.
tifiers: Canada, Federal-provincial conflicts, stitutional issues.

anada the development of oil and natural gas caused a conflict between dominion and incial legislation regulating this development. conflict has raised constitutional issues which ld be very similar to those raised if there was a lict over regulation of water resources elopment. The common areas of conflict would egulation of interprovincial trade, regulation conservation and regulation of the transporta- of the natural resources. Under the Canadian stitution provincial legislation controlling price upply in interprovincial trade is illegal unless control was incident to a valid provincial in-st. Thus provincial legislation concerning conation of natural resources which indirectly con-ed price or supply might be permissible. islation preventing 'physical waste' would be a l state interest, but legislation preventing nomic waste' would be questioned as uncon-tional. Legislation such as proration of produc- or export permits which might indirectly affect e or supply would probably stand a better nce of surviving a constitutional challenge if it for prevention of physical waste rather than nomic waste. Also provincial regulation of the sportation facilities for natural resources may constitutional questions. If the facilities such ipelines, motor carriers or pumping stations on ral watercourses were not connected with in-rovincial facilities or construction efforts the lation would stand. (Gadd-Fla)
-09793

ECTS OF WATER RESOURCES LAW IN NESOTA,
nesota Univ., Minneapolis. Water Resources arch Center.
nond A. Haik, William C. Walton, and David ills.
cts of Water Resources Law in Minnesota, Jun , Bulletin 2, p 1-142. 142 p, 258 ref.

riptors: *Minnesota, *Water resources lopment, *Judicial decisions, Legislation, ral government, State governments, Local rnments, Administration, Administrative cies, Permits, Water rights, Hydrologic cts, Water allocation (Policy), Water conser-n, Water control, Watercourses (Legal), r demand, Water management (Applied), r pollution, Water law, Legal aspects.

mpilation of state court decisions includes ses of decisions regarding: classification of s; rights in natural surface watercourses; in diffused surface waters; rights in natural d waters; rights in artificial watercourses; riptive rights; obstruction and diversion; er and assignment of water rights; and water quality. The compilation of state and local statutes presented includes analysis of statutes dealing with: the permit system; mining and the drainage and diversion of water; county and judicial drainage systems; dams and lake water levels, irrigation, pollution control; fish management; topographic and geological surveys; water-borne transportation; water-safety laws; state and federal-state planning; joint control of interstate waters; regulatory programs; water policies of the state; and the numerous administrative bodies responsible for the foregoing. Certain aspects of federal statutes and Supreme Court decisions are analyzed with regard to the role of the federal government and conflicts of federal-state jurisdiction. Conclusions and recommendations are made in light of the foregoing analyses. An appendix contains an unofficial compilation of statutes dealing with water and related land resources passed by the 1969 state legislature. (Keith-Fla)
W69-09794

STATE JUDICIAL CLASSIFICATIONS OF WATER AND STATE JUDICIAL DETERMINATION OF RIGHTS IN NATURAL SURFACE WATERCOURSES,
Minnesota Univ., Minneapolis. Water Resources Research Center.
Raymond A. Haik, William C. Walton, and David L. Hills.
Aspects of Water Resources Law in Minnesota, Jun 1969, Bulletin 2, p 4-22. 18 p, 78 ref.

Descriptors: *Minnesota, *Classification, *Judicial decisions, *Water rights, Legal aspects, Water law, Riparian rights, Natural streams, Reasonable use, Appropriation, Public rights, Surface waters, Subsurface waters, Surface runoff, Confined water, Water utilization, Water users, Priorities, Navigable waters, Ownership of beds, Percolating water.

The state judiciary has set up two systems of water classification. The systems used to determine respective private rights distinguishes between waters on the surface of the earth and waters under the surface of the earth. Water on the surface of the earth is defined to include diffused surface waters, natural watercourses, natural bodies of water, and artificial surface watercourses. Water under the surface of the earth is defined to include underground waters in definite streams, underground percolating waters, and artesian waters. Each subclassification is defined. The system used to resolve private-public use conflicts distinguishes between public and private waters; private water is defined as diffused surface water and public water includes all of the other foregoing subclassifications. By way of contrast, hydrologic classifications are discussed. The state judiciary has adopted part of the appropriation doctrine and part of the riparian doctrine for use in determination of rights in natural surface watercourses. Cases dealing with the following are analyzed in light of these two doctrines: reasonable use theory; users of water; priorities as to competing uses; navigable waters; ownership of watercourses, beds and overlying waters; and legal differences with respect to streams, lakes, ponds, and watercourses. (Keith-Fla)
W69-09795

STATE JUDICIAL DETERMINATION OF RIGHTS RELATIVE TO DIFFUSED SURFACE WATERS, NATURAL GROUND WATERS, ARTIFICIAL WATERCOURSES, AND OTHER COMMON LAW PRINCIPLES,
Minnesota Univ., Minneapolis. Water Resources Research Center.
Raymond A. Haik, William C. Walton, and David L. Hills.
Aspects of Water Resources Law in Minnesota, Bulletin 2, Jun 1969, p 22-37. 15 p, 68 ref.

Descriptors: *Minnesota, *Judicial decisions, *Reasonable use, *Relative rights, Surface runoff, Repulsion (Legal aspects), Cities, Remedies, Artificial watercourses, Prescriptive rights, Obstruction to flow, Diversion, Riparian rights, Legislation, Water permits, Water pollution, Water rights, Water law, Legal aspects, Water users, Alteration of flow.

The state courts first used the common enemy doctrine in deciding disputes regarding diffused surface water. The courts now use the reasonable use doctrine in deciding such disputes and have laid down guidelines for its application. The state courts have rejected the absolute ownership rule and correlative rights doctrine in determining relative rights to natural ground waters; the reasonable use doctrine is used instead. Although no state court has decided a case involving relative rights in artificial watercourses, the courts' tendency to treat artificial watercourses substantially the same as natural ones indicates that the courts will apply the reasonable use doctrine to artificial watercourses. The circumstances under which the courts have held for prescriptive rights with respect to riparian owners on altered natural watercourses and owners of land on which diffused surface waters are discharged are set forth. The circumstances under which obstruction and diversion are permitted and prohibited by the courts are discussed. The courts have ruled that riparian rights may be assigned to non-riparian owners, but it is noted that the statutory permit system has largely abrogated such rulings. Remedies for private and public pollution are discussed. (Keith-Fla)
W69-09796

ASPECTS OF STATE STATUTES I,
Minnesota Univ., Minneapolis. Water Resources Research Center.
Raymond A. Haik, William C. Walton, and David L. Hills.
Aspects of Water Resources Law in Minnesota, Jun 1969, Bulletin, p 39-51. 12 p, 34 ref.

Descriptors: *Minnesota, *Legislation, *Water conservation, *Water resources development, Water law, Judicial decisions, Administrative agencies, Water permits, Water allocation (Policy), Mining, Drainage, Diversion, Construction, Maintenance, Dams, Drainage districts, Pollution, Irrigation programs, Legal aspects, Regulation, Water pollution control, Drainage systems, Water levels, Programs.

A compilation of state statutes dealing with water law is presented. Each statute is accompanied by a discussion of how it does or may affect the corresponding common law dealing with water law. General charge and control over the waters of the state and of their disposition is given to the Commissioner of Conservation. He is given the power to devise and develop a general water resources conservation program for the state, which program shall contemplate the conservation, allocation, and development of all the waters of the state for the best interests of the people. The state permit system in theory adopts an appropriation concept, but in practice relies heavily on common law concepts to regulate waters. A water resources board is authorized in order to provide a forum for resolution of conflicting public interests. Permits for drainage, diversion, control, or use of water can be granted when necessary for mining. County boards and district courts are authorized to construct and maintain public drainage systems. Dams and lake water levels are specifically regulated. Drainage, conservancy, and watershed districts are authorized, and their powers and responsibilities are enumerated. Irrigation is regulated. Pollution is heavily regulated and several agencies police its regulation. (Keith-Fla)
W69-09797

ASPECTS OF STATE STATUTES II,
Minnesota Univ., Minneapolis. Water Resources Research Center.
Raymond A. Haik, William C. Walton, and David L. Hills.
Aspects of Water Resources Law in Minnesota, Jun 1969, Bulletin 2, p 51-77. 26 p, 23 ref.

Descriptors: *Minnesota, *Legislation, *Water resources development, *Administrative agencies, Geological surveys, Soil conservation, Legal aspects, Structures, Harbors, Port authorities, Planning, Multiple-purpose projects, Coordination, Great Lakes, Treaties, Water policy, Regulation, Project planning.

The powers of the State Board of Health with regard to the enforcing of specified water law statutes are enumerated. Topographic and geological surveys are authorized. The powers of soil conservation districts and the Game and Fish Commission relative to water law are listed. Water-borne transportation and facilities therefore are provided for and regulated. County sheriffs are charged with the responsibility of enforcing water safety laws. Numerous administrative agencies are charged with the coordination, planning, and carrying out of varied water-related programs. The compacts, agreements, and treaties resulting from the state bordering on the Great Lakes are all noted briefly. The policies of the state with regard to water and water-related problems are enumerated as abstracted from policy declarations and the state laws. Provision is made for mandatory coordination and cooperation of all agencies and other organizations dealing with water and related land resources. (Keith-Fla)
W69-09798

ASPECTS OF FEDERAL STATUTES AND SUPREME COURT DECISIONS,
Minnesota Univ., Minneapolis. Water Resources Research Center.
Raymond A. Haik, William C. Walton, and David L. Hills.
Aspects of Water Resources Law in Minnesota, Jun 1969, Bulletin 2, p 79-96. 17 p, 47 ref.

Descriptors: *Minnesota, *Federal government, *Legislation, *Judicial decisions, Water law, Legal aspects, Administrative agencies, Flood control, Water resources development, Multiple-purpose projects, Recreation, Water pollution, Federal jurisdiction, Federal-state water rights conflicts, State jurisdiction, Federal project policy.
Identifiers: *Federal policy, Constitutional authority.

A discussion of the federal government's impact on the field of water law begins with a consideration of the constitutional authority for federal participation and their historical entry into the field. An analysis of the role of federal government includes discussions of federal cases and statutes, defines the jurisdiction of the federal government, and makes the point that federal regulations control over state law in case of conflict. Separate discussions explore the expanding role of the federal government in the areas of flood control, water resources development, multiple-purpose water resource development projects, water pollution, and recreational use of water. Two discussions center around criticisms aimed at the federal government: its forcing of the states to bypass their existing governmental units because of federal financial incentives, and its failure to require integration of efforts under a comprehensive plan covering all involved governmental units and agencies. A discussion of conflicts of federal-state jurisdiction begins by pointing out that by looking at 'jurisdiction' in the sense of 'power to act', the federal government is shown to have almost unlimited jurisdiction over water. While the need for a national water resources policy is conceded, methods for resolving conflicts are proposed. (Keith-Fla)
W69-09799

CONCLUSIONS AND RECOMMENDATIONS,
Minnesota Univ., Minneapolis. Water Resources Research Center.
Raymond A. Haik, William C. Walton, and David L. Hills.
Aspects of Water Resources Law in Minnesota, Jun 1969, Bulletin 2, p 97-105. 8 p.

Descriptors: *Minnesota, *Water resources development, *Water law, *Administrative agencies, Federal government, Legislation, Judicial decisions, Coordination, Irrigation, Irrigation permits, Hydrologic data, Water permits, Diversion, Water transfer, Watershed management, Water rights, Legal aspects, Classification, Flood control.
Identifiers: *Federal policy, *State policy, Cooperation.

To increase the working efficiency of the numerous organizations participating in water resources activities carried on within the state, responsibility for comprehensive coordination and cooperation should be centralized; efforts to achieve this goal have thus far proved unfruitful. The state's combined common law and statutory scheme for determination of relative rights with respect to water use is well adapted t o the needs of the state. The state's irrigation policy should be based on hydrologic conditions. The water permit system should allow for controlled transfers and diversions of water from one watershed to another. The permit system needs modification to reduce the uncertainty of water rights, and to provide definite criteria for permit granting. The present legal classification of water should be replaced by hydrologic classifications. The state should take greater responsibility in the area of flood control. Congress should curtail the extent to which the federal government exercises its powers in the area of water resources and should give states and localities a stronger voice in federal programs. (Keith-Fla)
W69-09800

STATE V MANNING (ACTION FOR TRESPASS ON A LAKE).

165 SE 2d 13-15 (NC Ct App 1969).

Descriptors: *North Carolina, *Lakes, *Recreation, *Leases, Judicial decisions, Legal aspects, Fishing, Hunting, Dams, Ponds, Waterflow, Riparian land, Riparian waters, Recreation facilities, Water resources development, Riparian rights, Land tenure.
Identifiers: Trespass, Penalties (Criminal).

The defendants were charged with trespassing on a lake which was posted with 'no trespassing' signs. The lake had been developed by a corporation formed to build a dam to create the lake. The corporation was a private club whose members had fishing privileges in the lake. The club leased all the property surrounding the lake, including the lake itself. The defendants were arrested pursuant to a request by the club president. The court stated that it was irrelevant whether the lake was a 'private pond' because that factor had no bearing on the trespass statute. The court held that the trespass statute would only authorize arrests incident to the consent of the owners. The court further stated that a lessee is not an owner under the law, and therefore the club could not supply the necessary consent for the arrest of the defendants. The court granted the defendants' motion for a nonsuit. (Shevin-Fla)
W69-09801

ZABEL V TABB (PERMIT TO DREDGE AND FILL IN NAVIGABLE WATERS).
For primary bibliographic entry see Field 04A.
W69-09802

POISONING OR CONTAMINATING WATER.
For primary bibliographic entry see Field 05G.
W69-09803

WATER POLLUTION CONTROL COMPACT.
For primary bibliographic entry see Field 05G.
W69-09804

DUTIES AND POWERS OF STATE HIGHWAY DEPARTMENT.
For primary bibliographic entry see Field 04A.
W69-09805

WATER POLLUTION CONTROL COMPACT
For primary bibliographic entry see Field 05G.
W69-09806

WATER POLLUTION CONTROL COMPACT
For primary bibliographic entry see Field 05G.
W69-09807

WATER POLLUTION CONTROL COMPACT
For primary bibliographic entry see Field 05G.
W69-09808

WATER POLLUTION CONTROL COMPACT
For primary bibliographic entry see Field 05G.
W69-09809

MERRIMACK RIVER FLOOD CONTR COMPACT.
For primary bibliographic entry see Field 06F.
W69-09810

CONNECTICUT RIVER FLOOD CONTR COMPACT.
For primary bibliographic entry see Field 06F.
W69-09811

PUBLIC HEALTH (DRAINAGE, PUB POOLS AND BATHING PLACES).
For primary bibliographic entry see Field 05G.
W69-09812

DRAINAGE OF LAND ADJACENT PUB ROADS.
For primary bibliographic entry see Field 04A.
W69-09813

COASTAL FISHERIES LAWS (FISH A GAME).

SC Code Ann secs 28-770 thru 28-991 (1962 amended, (Supp 1968).

Descriptors: *South Carolina, *Commercial f ing, *Fish, *Fish conservation, Commercial f Legislation, Regulation, Shellfish, Commer shellfish, Oysters, Shrimp, Crabs, Clams, management, Fisheries, Fish handling facili Saline water fish, Ownership of beds, Beds un water, Leases.
Identifiers: *Bed limits and dimension.

South Carolina may regulate coastal fishing wi the territorial jurisdiction of the waters of the st Special regulations apply to oyster, shrimp, cr and clam cultivation, harvest, and processing. C tain geographical areas are delineated in wh shrimp trawling will be allowed, depending on season. Regulations are specified concerning taking of blue crabs, including the geograph areas and seasons for harvest. The geograph areas and seasons during which shad and sturg may be taken are delineated. Portions of bot land owned by the state may be leased for the pose of commercial oyster culture, not to exc one thousand acres to any one person for lon than five years. Regulatory provisions for non-f fish and for the use and construction of seines nets in general as well as penalties, licensing, taxing provisions applicable to all fish gathe from state waters are provided. Included in th provisions are shrimp and crab boat licen pealers and processors licenses, non-food fish f ing licenses, wholesaler and power boat licen and shipping certificate provisions. (Moulder-Fl W69-09814

FISH PROTECTIVE REGULATIONS.

Ill Ann Stat ch 56, secs 160-161 (Smith-H 1967), as amended, (Supp 1969).

criptors: *Illinois, *Wildlife conservation, h management, *Fish, Turtles, Crayfish, Mus- Sewage, Water pollution, Damages, Ice, er, Aquatic life, Fishing, Fish conservation, slation, Legal aspects, Water law, Regulation, er pollution control, Seasonal.

state has title to all fish, frogs, turtles and cray- within the jurisdiction of the state and none of same may be taken in any manner except as ided by law. Any person who causes waste or ge to be discharged into the waters of the state to kill aquatic life is liable in damages to the . Persons may not deposit rubbish, trash or r insoluble materials into the waters or upon ce of any waters of the state. Protected forms quatic life include a number of varieties of fish, ain turtles, certain frogs and mussels, none of h may be taken by devices defined as illegal by act. Seasons are established when certain fish be taken. (Johnson-Fla)
-09815

RTS AND MARITIME MATTERS.
primary bibliographic entry see Field 04A.
-09816

Y OF COON RAPIDS V SUBURBAN EN- EERING INC. (FAILURE TO MEET CIFICATIONS FOR A DRAINAGE TEM).
primary bibliographic entry see Field 04A.
-09817

TENSION OF BOULEVARD OVER PUBLIC TER WAYS.
primary bibliographic entry see Field 04A.
-09818

VIGATION AND WATERS (VESSELS).
primary bibliographic entry see Field 04A.
-09819

ERS AND STREAMS (GENERAL PROVI- NS).
primary bibliographic entry see Field 04A.
-09820

VIGATION AND WATERS.
primary bibliographic entry see Field 04A.
-09821

ITARY WATER BOARD.
primary bibliographic entry see Field 05G.
-09822

OD CONTROL.
primary bibliographic entry see Field 04A.
-09823

UISITION OF UTILITIES AND RECLAMA- N OF PREVIOUSLY SUBMERGED LAND CITIES.
primary bibliographic entry see Field 04A.
-09824

TER SUPPLY, DRAINAGE FLOOD CON- L.
primary bibliographic entry see Field 04A.
-09825

VIDUAL DRAINAGE RIGHTS.
primary bibliographic entry see Field 04A.
-09826

INAGE AND LEVEE DISTRICTS WITH PING STATIONS.
primary bibliographic entry see Field 04A.
W69-09827

IOWA NATURAL RESOURCES COUNCIL.
For primary bibliographic entry see Field 06B.
W69-09828

FEDERAL FLOOD CONTROL COORDINATION.
For primary bibliographic entry see Field 04A.
W69-09829

BRIDGES OVER NAVIGABLE RIVERS.
For primary bibliographic entry see Field 04A.
W69-09830

DEPARTMENT ACQUISITION AND OPERATION OF CERTAIN FERRIES.
Ill Ann Stat ch 121, secs 10-901, 10-902 (Smith-Hurd 1960).

Descriptors: *Illinois, *Rivers, *Condemnation, *Operation and maintenance, Legislation, Boats, Facilities, Highways, State governments, Census, Maintenance, Operations, Transportation, Regulation, Administrative agencies.
Identifiers: *Ferries, *Illinois River, Counties, Ferry landings.

The highway department may purchase or condemn the franchise and all equipment, boats, landing facilities, and other appurtenances of any ferry in existence on March 15, 1959, operating on the Illinois River and connecting any road from a county having not more than 7000 inhabitants, with any state highway in a county of not more than 16,000 inhabitants. The department may operate any ferry service for the conveyance of persons across the Illinois River so long as such operation is justified by the amount of traffic using such ferry. The location of the ferry landings and the route of the ferry shall be determined by the department. (Shevin-Fla)
W69-09831

COUNTY TOLL BRIDGES.

Ill Ann Stat ch 121, secs 10-301, 10-302 (Smith-Hurd 1960).

Descriptors: *Illinois, *Bridges, *Local governments, *Operation and maintenance, Legislation, Navigable waters, Non-navigable waters, Legal aspects, Bridge construction, Eminent domain, Repairing, Boundaries (Property).

Each county of this state is authorized to acquire, construct, repair, maintain and operate bridges over and across any navigable or non-navigable stream within such county, or forming a boundary line between such county and any other county in this state, or forming a boundary line between the state of Illinois and any adjoining state. Every county which exercises its powers under this article shall have the right of eminent domain. (Heckerling-Fla)
W69-09832

DIVISION OF COMMERCIAL FISHERIES.
SC Code Ann secs 28-159 thru 28-180 (1962), as amended, (Supp 1968).

Descriptors: *South Carolina, *Marine fisheries, *Fish management, *Commercial fishing, Commercial shellfish, Commercial fish, Administrative agencies, Legislation, Regulation, State jurisdiction, Atlantic Ocean, Saline water, Fishing, Marine fish, Fish conservation, Permits, Taxes, Administration, Legal aspects.
Identifiers: Law enforcement, Licenses, Penalties (Civil).

The Division of Commercial Fisheries shall have jurisdiction over all saltwater fishing and all fisheries in the state whereupon a tax or license is levied for commercial purposes. The Division may expend up to $100 per annum in the experimental propagation of shellfish. Six launches shall be purchased and maintained by the Division as a police fleet. Inspectors appointed by the Division may wear uniforms and badges and shall have the power to enter vessels and any premises and to arrest for violations of the Coastal Fisheries Laws. The Division may adopt rules and regulations for the control of fisheries not contrary to state law and provide penalties for their violation. Records shall be kept of: leases granted for bottoms used in shellfish propagation; the amounts of all permits issued; the commercial value of all fish taken in the state; and the number and earnings of men engaged in the fishing industries. The Division may prosecute for the collection of revenue due from fishing industries and employ counsel with special knowledge of fisheries laws to that end. (Kahle-Fla)
W69-09833

MISSISSIPPI BRIDGES PURCHASED.
For primary bibliographic entry see Field 04A.
W69-09834

DRAINAGE.
For primary bibliographic entry see Field 04A.
W69-09835

OHIO RIVER VALLEY WATER SANITATION.
For primary bibliographic entry see Field 05G.
W69-09836

CHANGES IN ROADS, STREAMS, OR DRY RUNS.
For primary bibliographic entry see Field 04C.
W69-09837

SOIL CONSERVATION.
For primary bibliographic entry see Field 04D.
W69-09838

WATER NAVIGATION REGULATIONS.
For primary bibliographic entry see Field 04A.
W69-09839

STATE CONSERVATION COMMISSION.

Iowa Code Ann secs 107.28-107.34 (Supp 1969).

Descriptors: *Iowa, *Conservation, *Recreation facilities, *Watershed management, Legislation, Administrative agencies, Federal government, Project planning, Fish conservation, Financing, Project purposes, Public benefits, Recreation, Watersheds (Basins).
Identifiers: *Conservation commission.

The state conservation commission is hereby authorized to perform such acts as may be necessary to the conduct and establishment of cooperative fish restoration projects in compliance with federal acts and regulations. The commission is also authorized to perform such acts as may be necessary to conduct and establish cooperative outdoor recreational and watershed facilities as may be defined by the Congress of the United States and may accept federal funds for such projects. The state and its subdivisions should enjoy the benefits of federal assistance programs for the planning and development of outdoor recreation resources. The commission is authorized to prepare, maintain, and keep up-to-date a comprehensive plan for the development of the outdoor recreation resources of the state and to acquire lands, waters, and interests in lands and waters for such areas. The commission may apply for funds from any appropriate federal agency. (Heckerling-Fla)
W69-09840

FISH AND GAME CONSERVATION.

Iowa Ann Code secs 109.99-109.101, 109.105 (1949), as amended, (Supp 1969).

Descriptors: *Iowa, *Mussels, *Regulation, Legislation, Mississippi River, Missouri River, Administrative agencies, Baits, Bait fishing, Administration, Shellfish, Fish management, Fish harvest, Permits.
Identifiers: Des Moines River.

It is unlawful to take, catch, or kill mussels for commercial purposes without first procurring a mussel license. Mussels may be taken from the Mississippi and Missouri rivers at any time and may be taken from designated portions of the Red Cedar, Iowa, and Des Moines rivers between June 15 and November 30, of each year. All other state waters are closed. Manufacturers of pearl buttons or fish bait may possess mussels lawfully taken, and a licensed fisherman may take mussels to be used by him for bait or food. All holders of mussel licenses must report before April 1 of each year to the Fish and Game Commission the weight of his catch, where they were taken, and the amount received for the shells. (Holt-Fla)
W69-09841

COMMERCIAL FISHING.

Iowa Code Ann secs 109.106-109.120 (1949), as amended, (Supp 1969), sec 109.121 (Supp 1969).

Descriptors: *Iowa, *Fish conservation, *Commercial fishing, *Fishing gear, Catfishes, Mississippi River, Missouri River, Regulation, Nets, Tributaries, Legislation, Water policy, Minnows, Administrative agencies, Administration.

Except for taking minnows or as otherwise provided, it is unlawful to take fish by seines or other devices. The use of seines and other devices for catching fish is restricted in tributaries emptying into the Mississippi. All seines and other devices for taking fish must be properly licensed. Fish salesmen may not possess catfish under 13 inches. The size of mesh or seines and the sizes of other fish-taking devices are controlled. Enumerated fish-taking devices may be used in the Mississippi and Missouri rivers, and designated fish may be taken therefrom. Certain fish species that meet minimum weight or length requirements may be taken from the Mississippi and Missouri rivers. Commercial fishermen may retail or wholesale their catches but all other salesmen must procure a license. Commercially licensed fishermen must annually report to the fish and game commission the amount of their catch and where and how their catch was taken. It is unlawful to market fish without first procuring a license. Records of the species and quantities of all fish taken from Iowa waters and handled by the licensee must be kept for each license year. Punishments are provided for violating the above provisions. (Holt-Fla)
W69-09842

BENEFITED WATER DISTRICTS.
For primary bibliographic entry see Field 04A.
W69-09843

WATER AND AIR POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W69-09844

WATER AND AIR POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W69-09845

SOUTH CAROLINA WILDLIFE RESOURCES DEPARTMENT.
SC Code Ann secs 28-93, 28-97, 28-100, 28-101, 28-104, 28-106, 28-107, 28-108 (1962), as amended (Supp 1968).

Descriptors: *South Carolina, *Wildlife conservation, *Commercial fishing, *Hunting, Sport fishing, Regulation, Administrative agencies, Legislation, Adjudication procedure, Permits, Taxes, Fish conservation, Shellfish, Commercial shellfish, Shrimp, Fish management.
Identifiers: Law enforcement.

The Wildlife Resources Commission is established as a branch of the Wildlife Resources Department. All functions of the commission shall be performed by the Division of Game and the Division of Commercial Fisheries. The Division of Game shall function to conserve game and enforce tax and license laws relating to game and private fishing. The Division of Commercial Fisheries shall embrace the conservation of shellfish and commercial fishing and the execution of license and tax laws pertaining thereto; provided that the enforcement of such laws shall be performed by the Division of Game. The Division of Commercial Fisheries shall consist of a director, skilled in the conservation of commercial fishing resources, and such employees as may be necessary. The commission shall hold hearings in all matters relating to shellfish, shrimp, and commercial fishing. Appeals may be taken to the courts in all matters as were formerly appealable from the State Board of Fisheries. Authorized agents of the Wildlife Resources Department may conduct scientific investigations at the request of the directors of the Divisions of Game and Commercial Fisheries. The department may acquire land for the purpose of maintaining game and fish preserves. The commission shall have charge of state game wardens and supervise enforcement of state laws pertaining to game and fisheries. (Kahle-Fla)
W69-09846

UNLAWFUL TO SWIM IN CERTAIN AREA.

SC Code Ann, sec 51-240 (1962).

Descriptors: *South Carolina, *Swimming, *Boat-launching ramp, *Regulation, Competing uses, Legislation, Legal aspects, Recreation, Water sports, Recreation facilities, Water policy, Public rights, Boating.
Identifiers: Penalties (Civil).

Swimming between the boat landing at Brighton Beach and the dock of J. E. Smith is unlawful. Violations of this provision are punishable by a fine not more than $100 and imprisonment not more than 30 days. (Breeze-Fla)
W69-09847

STATE BOARD OF HEALTH; SHELLFISH.

17 SC Code Ann 250-253 (1962).

Descriptors: *South Carolina, *Commercial shellfish, *Environmental sanitation, *Permits, Interstate, Administrative agencies, Regulation, Legislation, Public health, State governments, Surveys, Inspection.
Identifiers: *Public Health Service, Packing, Shucking, Records.

Any person, firm, corporation or association shucking, packing or selling shellfish must first obtain and display a permit from the State Board of Health. In order to provide sanitary control of the shellfish industry, the state, industry, and the Public Health Service shall be responsible for certain procedures. The state shall regulate the industry and the regulatory authority shall inspect, survey and condemn growing areas and patrol restricted areas. The authority shall inspect plants, issue certificates to producers and dealers and supply records to the Public Health Service. The certificate holders shall place their certificate number on all packages of shellfish shipped in interstate commerce and keep records which may be inspected by the regulatory authority and the Health Service. The Health Service shall inspect and rate plants in each state and keep a list of authorized interstate shippers and publish the list for the use of consumer states. Statutory definitions given shall apply in the interpretation of the rules and regulations set forth for control of the industry. (Harris-Fla)
W69-09848

CHICAGO PARK DISTRICT: ACQUISITION O RIPARIAN RIGHTS AND HARBOR DEVELO MENT.

Ill Ann Stat ch 105, secs 333.15, 333.20, 333.2 thru 333.23u (Smith-Hurd Supp 1969).

Descriptors: *Illinois, *Parks, *Harbors, *Wa resources development, Administrative agenci Condemnation, Riparian rights, Bonding, Legis tion, Leases, Taxes, Recreation facilities, Recre tion, Operation and maintenance, Public benefi Project planning, Cities, Land tenure, Ownersh of beds, Beds under water, Cost repayment, Le aspects, Financing, Regulation, Real property.
Identifiers: Chicago Park District.

The Chicago Park District shall have the power acquire any and all real estate, riparian estates rights, and other property needed for developing park and for improving wharfs, piers, jetties, a shore protection works associated with such par The District may issue bonds for payment of la so acquired and for the other improvements mad The District may maintain a harbor for recreatio use and benefit of the public and the district sh have certain enumerated rights and powers ov such harbor. Any right or interest of the state submerged lands within the harbor shall be vest in the District. The District shall have the power borrow on the anticipated revenue of the harb and set up ordinances for the acquisition of the ha bor. (Heckerling-Fla)
W69-09849

UNIFORM STATE LAW FOR AERONAUTICS

SC Code Ann secs 2-2, 2-4 thru 2-6 (1962).

Descriptors: *South Carolina, *Aircraft, *Navi tion, *Competing uses, Regulation, Damag Legislation, Legal aspects, Hydrofoils, Transpor tion, Water rights, Public rights, Preferen (Water rights), Boundaries (Property), Priorit Boundaries (Surfaces), Land tenure, Relat rights.

'Aircraft' means any vehicle used for navigat through the air including a hydroplane hydroplane is governed by water navigation ru while at rest on the water or while operated on immediately above the water. It is treated as an craft while operated in the air other than mediately above the water. Flight over land water is lawful as long as it does not interfere w existing uses or become imminently dangero (Breeze-Fla)
W69-09850

VAN DUYSE V FLEMING (NATUR DRAINAGE OVER ADJACENT LAND).
For primary bibliographic entry see Field 04A.
W69-09851

SOLOMON V CONGLETON (RIGHT TO C STRUCT NATURAL WATERCOURSES A SURFACE DRAINAGE).
For primary bibliographic entry see Field 04A.
W69-09852

STEWART V STEPHENS (WATERCRA OPERATION).
166 SE 2d 890-893 (Ga 1969).

Descriptors: *Georgia, *Boating, *Swimmi *Water sports, Boats, Lakes, Recreation, Admi trative agencies, Administrative decisions, Judi decisions, Legal aspects, Regulation.
Identifiers: Family purpose doctrine, Watercraft

While swimming in a Georgia lake, a 16 year boy was run into and cut to death by a boat own by defendant and operated by his 13 year daughter. The boat was kept by defendant for comfort, pleasure and convenience of his fam The mother of the decedent brought a wron

th action alleging application of the family pur-
e doctrine and violation of a regulation promul-
ed by the State Game and Fish Commission stat-
that the owner of a watercraft shall be liable for
injury or damage occasioned by the negligent
ration of such watercraft. The lower court held
family purpose doctrine not applicable to boats
gave judgment for plaintiff. On appeal by de-
lant the appellate court reversed. On certiorari,
Georgia Supreme Court held that the family
pose doctrine is applicable to boats. The court
further that the Game and Fish Commission
eeded its delegated authority in adopting a rule
ivil liability between private citizens in that the
slature did not authorize the commission to
pt a rule rendering liable the owner of water-
t for their negligent operation. (Carruthers-
)
9-09853

RTSMOUTH-KITTERY BRIDGE.

Rev Stat Ann secs 258:1 thru 258:16 (1964).

criptors: *New Hampshire, *Interstate com-
ts, *Bridges, *Administrative agencies, Water
, Legislation, Legal aspects, Jurisdiction, Ad-
istration, Financing, Government finance,
al governments, Federal government, State
ernments, Bridge construction, Interstate com-
sions, Political aspects, Cooperatives, Coor-
ation, Planning costs, Cost allocation, Projects,
ject planning, Highways, Bonding.
ntifiers: Interstate bridges, Toll bridges.

v Hampshire and Maine agree to build a bridge
ween the towns of Portsmouth and Kittery by
blishing 'The Maine-New Hampshire Interstate
dge Authority' which has full authority over
rdination of matters relating to construction of
h bridge. The authority is incorporated within
state of New Hampshire with full corporate
vers which are enumerated at length. The
nority may also issue bonds to finance such con-
ction. Specific provisions are set forth for the
ment of these bonds and for the protection of
bondholders. (Johnson-Fla)
9-09854

RTSMOUTH-KITTERY BRIDGE COMPACT.

Rev Stat Ann sec 258:1 (1964).

scriptors: *New Hampshire, *Interstate com-
ts, *Bridges, *Administrative agencies, Ad-
istration, Legislation, Water law, Legal aspects,
itical aspects, Bridge construction, Real proper-
Right-of-way, Financing, Regulation, State
ernments, Governments, Maine, Interstate
mmissions, Operation and maintenance.
ntifiers: Toll bridges.

ause the existing bridge was inadequate for
er highway or rail traffic and because upstream
mmerce on the Piscataqua River was hampered
the narrow drawspan on the old bridge, New
mpshire and Maine entered into a compact to
perate in the building of a new bridge between
tsmouth and Kittery which would be adequate
serve the needs of both land and water borne
mmerce. The compact creates the Maine-New
mpshire Interstate Bridge Authority, the sole
pose of which is to supervise and coordinate the
struction of said bridge. The Authority has the
ver and authority to sue and be sued, construct,
ntain and operate an interstate toll bridge
ween the points previously indicated, acquire
h real property as necessary for same, charge
collect fees, enter contracts, and other powers
essary to the fulfillment of its function. A
mber of other administrative details may be
nd in the compact dealing with such things as
ability to make rules and to incur obligations
salaries as well as regulation of the business af-
s of the Authority. (Johnson-Fla)
9-09855

PORTSMOUTH-KITTERY BRIDGE.

NH Rev Stat Ann secs 258:2 thru 258:7 (1964).

Descriptors: *New Hampshire, *Interstate compacts, *Bridge construction, *Financing, Bridges, Administration, Legislation, Legal aspects, Water law, Federal government, State governments, Project planning, Costs, Local governments, Cost repayment, Political aspects, Bonding, Operation and maintenance.

The compact provides that the governor of New Hampshire shall appoint three residents of the state to be members of 'The Maine-New Hampshire Interstate Bridge Authority.' Such members then have to submit the compact for approval to the Congress of the United States. The Authority is incorporated under the laws of New Hampshire and has the powers necessary for the construction, operation, and maintenance of an interstate toll bridge between Portsmouth and Kittery. The Authority has power to issue negotiable bonds for the purpose of paying the costs of the bridge and its highway approaches, but such bonds do not constitute a debt of the state or any agency or political subdivision thereof. (Johnson-Fla)
W69-09856

SACHS V CHIAT (DAMAGE FROM SURFACE WATER RUNOFF).
For primary bibliographic entry see Field 04A.
W69-09857

HENSON V GERLOFS (LANDFILLS UPON PUBLIC EASEMENT).
13 Mich App 435, 164 NW 2d 533-539 (1968).

Descriptors: *Michigan, *Riparian rights, *Easements, *Landfills, Earthworks, Land forming, Lakes, Navigable waters, Bodies of water, Streams, Public land, Recreation, Boating, Riparian land, Legal aspects, Prescriptive rights, Water rights, Judicial decisions, Access routes, High water mark.
Identifiers: Prescriptive easements, Injunctions (Mandatory).

Plaintiffs were owners of land located on two navigable lakes which were connected by a stream. Defendants intended to improve by filling the property lying between the two lakes for commercial recreational purposes. The public had a right of ingress and egress by a prescriptive easement over the filled land to the lakes. Plaintiffs, as riparian owners and as members of the public sought a mandatory injunction against continued filling and an order to remove a portion of the fill. The trial court granted the relief and defendants appealed. The court found that evidence of both parties as to the area covered by the public easement coincided and held that the injunction issued covered more than this area. The injunction should have been limited to the areas over which the easements existed. The court also found that portions of the fill were on dryland above the ordinary highwater mark and did not interfere with the rights of riparian owners or the general public but provided better access to the lake and connecting stream. Defendants therefore did not have to remove this portion of the fill. (Helwig-Fla)
W69-09858

STATE BOUNDARIES.

NH Rev Stat Ann secs 1:1, 1:4 (1955).

Descriptors: *New Hampshire, *Boundaries (Property), *Alteration of flow, *Structures, Boundaries (Surfaces), Interstate, Vermont, Obstruction to flow, Flow augmentation, Dams, Banks, Beds, Flow, Permits, Legal aspects.
Identifiers: *Connecticut River, Penalties (Civil).

No alteration of the banks or bed of the Connecticut River, erection of any structure thereupon, or any other operation affecting the flow of the river, so as to make difficult the ascertaining of the boundary line between New Hampshire and Vermont, shall be commenced without first giving notice to the attorneys-general of each state. Failure to give such notice is punishable by fine not to exceed $5000. (Kahle-Fla)
W69-09859

COLLECTING SEAWEED.

NH Rev Stat Ann secs 572:28-572:34 (1955).

Descriptors: *New Hampshire, *Marine plants, *Aquatic life, *Aquatic plants, Plants, Planting management, Seashores, Sea water, High water mark, Salt marshes, Shallow water, Shoals, Tidal marshes, Tides, Marshes, Marsh plants, Land tenure, Legislation, Legal aspects, Water law, Banks, Shores, Rocks, Root systems, Conservation, Administrative agencies, Tidal waters, Mosses.
Identifiers: Seaweed, Sea moss, Rockweed, Flatsweed.

Any person collecting or carrying away seaweed or rockweed at night from the seashore below the high water mark shall be fined. Any person carrying away any seaweed cast upon flats or salt marsh by the sea or tide, without leave of the owner, shall be fined. Any person piling seaweed or rockweed below the high water mark for the purpose of hauling it away, shall be fined. Any person carrying away seaweed, rockweed or sea moss for sale or transportation outside this state shall be fined. Any person taking or uprooting growing rockweed or sea moss from the rocks, banks or shores of this state, except by cutting same with a knife so as not to injure its roots, shall be fined. Any person taking or cutting more than three bushels per day of rockweed or sea moss growing below the high water mark shall be fined. Fish and game conservation officers and all state and local police officers shall enforce all laws relating to such collecting, carrying away, uprooting, piling and selling of seaweed, rockweed, flats-weed and sea moss. (Carruthers-Fla)
W69-09860

MARINE FISHERIES.

NH Rev Stat Ann secs 211:65-211:70 (Supp 1967).

Descriptors: *New Hampshire, *Marine fisheries, *Commercial fishing, *Sport fishing, Shellfish, Commercial shellfishing, Marine fish, Permits, Regulation, Administrative agencies, Legislation, Fish conservation, Fish management, Fisheries, Oysters, Crabs, Clams, Federal government, State governments, Costs, Administrative costs, Resource development, Grants.

A division of marine fisheries is established in the department of fish and game for the purpose of regulating and promoting recreational and commercial marine fishing. 'Marine fisheries' refers to the taking of salt-water fish, crabs, oysters, clams and clam worms. The division is authorized to receive and spend gifts and grants from any source and to hold property acquired for projects approved by the Secretary of the Interior for research and development of commercial fisheries resources. The director of the fish and game department shall supervise the division, authorize expenditures from the marine fisheries fund and may hold hearings and issue regulations as provided by statute. The director shall appoint a marine biologist as chief of the division. The director shall employ such other help as is necessary for the control of marine fisheries. He may, until a permanent marine biologist is appointed, employ a consultant to set up a program and to train biologists and other employees. Such consultant may be paid $6000 a year from the marine fisheries fund, but may not be employed for a period longer than two years. Money collected from licenses, fines for taking shellfish, and gifts shall be kept in a separate marine fisheries fund to be used for expenses of the division. (Kahle-Fla)
W69-09861

PROPAGATION OF FISH AND GAME.
NH Rev Stat Ann secs 212:1-212:33 (1964).

Descriptors: *New Hampshire, *Fish management, *Fish conservation, *Administrative agencies, Legislation, Water policy, Legal aspects, Fish establishment, Fish reproduction, Fish stocking, Regulation, Permits, Administration, Fishing, Wildlife, Federal government, Condemnation, Condemnation value, Compensation, Economics, Wildlife habitats, Habitat improvement, Fish populations.

The state may condemn lands or waters for protection and propagation of fish or for fishing or administrative purposes in the event that said properties cannot be purchased or leased at a reasonable price. If the owner is dissatisfied with the payment for such properties, he may appeal the award to the county superior court. The director of the fish and game commission in conjunction with the commissioner of agriculture may establish game refuges for the protection and propagation of fish on state fish and game lands, on privately owned lands with the consent of the owner and abutters, or on state or national forest lands. The director may remove or transfer fish and he may sell or exchange fish, eggs or fry with other states or individuals in the interest of protection or propagation thereof. The state consents to the federal act of Congress dealing with fish restoration and management projects and empowers the director to consent to cooperative fish restoration and management projects. Licenses are required for those engaging in private propagation of fish. A provision limits the liability of landowners allowing the public to use their lands free of charge for hunting and fishing. (Johnson-Fla)
W69-09862

LICENSES.
NH Rev Stat Ann secs 214:1-214:23, 214:30-214:37 (1964), as amended, (Supp 1967).

Descriptors: *New Hampshire, *Permits, *Regulation, *Freshwater fish, Control, Fishing, Fish, Legal aspects, Legislation, Water policy, Administration, Administrative agencies, State governments, Wildlife conservation, Fish management, Hunting, Smelts, Bait fishing, Baits, Bait traps, Minnows, Fishing gear.
Identifiers: *Licenses.

Before any person, resident or nonresident, may hunt, fish, or take in any manner wild animals, he must purchase a proper license which he must display on his outer garment when hunting or fishing. Members of the armed forces, minor children, and resident owners of farm lands (while fishing on their own property) are excepted from the licensing requirements. Licensees are categorized and each group pays a special fee for the type of license purchased. Any license so issued is revocable upon conviction of a violation of any provision of this chapter. Any person who violates the provisions against throwing refuse into public waters may, in addition to the penalty therefore, lose his fishing or hunting license for the current year. A bait dealer must purchase a license to sell freshwater smelt; such license also authorizes the taking of such smelt. Equipment used to take live bait must be clearly marked with the name of the owner and user. (Johnson-Fla)
W69-09863

HAMPTON HARBOR AND BEACH EROSION CONTROL.
For primary bibliographic entry see Field 04A.
W69-09864

BACK CHANNELS OF PORTSMOUTH HARBOR; SHORE AND BEACH PRESERVATION AND DEVELOPMENT.

NH Rev Stat Ann secs 216-C:1 thru 216-C:16 (Supp 1967), 217:1 (1964).

Descriptors: *New Hampshire, *Channel improvement, *Projects, *Harbors, Administrative agencies, Administrative decisions, Federal government, State governments, Federal project policy, Investigations, Erosion, Erosion control, Shores, Coasts, Currents (Water), Waves (Water), Boating, Recreation, Water sports, Cities, Federal budget, Damages, Construction, Engineering, Legislation, Water law, Legal aspects, United States, Appropriation, Cost allocation, Costs, Cost sharing.
Identifiers: Corps of Engineers.

The public works and highway department, through cooperative study and investigation with appropriate agencies of the United States government, shall attempt to devise effective means of erosion prevention relative to the coastal shores of this state. The governor is authorized to undertake, in cooperation with the Army Corps of Engineers, a project to improve the back channels of Portsmouth Harbor for small boating. In this regard, the governor is authorized to act for the city of Portsmouth and other public local interests. But, no action under this authority shall be taken except where federal funds are found to be available for such projects and where state expenditure is economically justified, the New Hampshire state port authority, with the approval of the governor, is authorized to cooperate and enter into such agreements with the federal government as are deemed advisable and to render such assurance as may be required to obtain such funds. It is anticipated that the Corps of Engineers will supervise the construction of the cooperative projects and that upon completion the federal government will maintain the dredged channels while the city of Portsmouth will operate and manage the public landings or wharves. Any contracts let for construction of the projects shall be administered by the commissioner of public works and highways. The department of public works and highways is authorized to cooperate in engineering studies with the Corps of Engineers. (Carruthers-Fla)
W69-09865

LAY OUT OF HIGHWAYS TO PUBLIC WATERS.

NH Rev Stat Ann secs 235:1 thru 235:9 (1964).

Descriptors: *New Hampshire, *Highways, *Access routes, Condemnation, Eminent domain, Damages, Appropriation, Condemnation value, Assessments, Reservoirs, Cost allocation, Costs, Cost sharing, Administrative agencies, Administrative decisions, Land tenure, Land use, Locating, Public rights, Public benefits, Compensation, Gates, Cities, Legal aspects, Legislation, Water resources, Water users.
Identifiers: Public waters.

Upon petition and hearing, the governor may determine the necessity for laying a highway access route from any existing highway to any public water in this state. The governor shall also determine its location and appoint a commission to purchase the necessary land and complete the lay out. The governor, upon petition, may appoint a commission to determine whether there is occasion for the laying out of such highway. Notice of any hearing entailed by this procedure shall be given to the first petitioner and to each affected property owner and to the clerk of any affected city or town. Damages sustained by each property owner shall be assessed by the commission, which shall also pay such damages and file a return, and in all matters pertaining to such layout shall have the same powers and duties as commissioners have in laying out class I or II highways. Any landowner aggrieved by the commission's damage assessment may appeal to the superior court and have his damages assessed by jury. Any such highway may be made subject to gates or bars across the same. No such highway shall be laid out to any public waters used by any city or town for reservoir purposes. The state shall pay such portion of the commissioner's services, damage awards and construction costs as the governor shall deem just and reasonable. Th balance shall be paid by the affected towns. Suc highway shall be deemed a class V highway. Tow or the state are not liable for any injury to person property on any such highway. (Carruthers-Fla)
W69-09866

USE OF HOUSEBOATS.

NH Rev Stat Ann secs 270-A:1 thru 270-A:7 (Sup 1967).

Descriptors: *New Hampshire, *Boats, *Boatin regulations, *Pollution abatement, Regulatio Legislation, Administrative agencies, Navigab waters, Surface waters, Inland waterways, Lease Permits, State jurisdiction, Water pollution contro Identifiers: *Houseboats, Mooring, Penalti (Civil).

The terms 'person', 'houseboat', 'overnight period and 'mooring' are defined. A houseboat may b beached or tied to the shore of any inland surfac waters of the state for an overnight period, or pa thereof, only at a location owned or leased by th operator of the houseboat, by permission of th owner of such location or in case of emergenc Houseboats may not be anchored on inland surfac waters except in case of emergency. The person control of a location where one or more houseboa are anchored or moored for an overnight period, part thereof, must give prompt notice of such fa to the New Hampshire Water Supply and Pollutio Control Commission stating the number houseboats and dates of mooring. Persons wh lease spaces for mooring houseboats must keep log of all such houseboats, the names of the owne of such houseboats and the dates of such moorin which log shall be available for inspection by th Commission. (Kahle-Fla)
W69-09867

OBSTRUCTING WATER; PENALTY.

NH Rev Stat Ann sec 249:22 (1964).

Descriptors: *New Hampshire, *Highways, *Dive sion, *Obstruction to flow, Alteration of flo Streams, Rivers, Legislation, Local government Administrative agencies, Highway effects, Floo ing, Flood damage, Floods, Diversion.
Identifiers: Penalties (Civil).

If any person places, or allows to be placed remain, any logs, earth or other substances near highway thereby diverting water upon the highw and rendering it unfit for travel he shall be fined n to exceed $100. (Kahle-Fla)
W69-09868

NEW HAMPSHIRE STATE PORT AUTHORIT

NH Rev Stat Ann secs 271-A:1 thru 271-A: (1966).

Descriptors: *New Hampshire, *Port authoritie *Administrative agencies, *Regulation, Sta governments, Federal government, Harbo Legislation, Legal aspects, Navigable waters, Tid waters, Boats, Boating, Fishing, Water spor Recreation, Commercial fishing, Rivers, Transpo tation, Land use, Piers, Construction, Industri Control, Operation and maintenance.
Identifiers: Harbor masters, Pilots, Ports.

There shall be established a New Hampshire Sta Authority. The authority shall: (1) plan for t maintenance and development of the ports, ha bors, and navigable tidal rivers of the state; (2) a in the development of salt wa'er fisheries; (cooperate with federal governmental agencies; a (4) plan and develop air navigation and land tran portation facilities near Portsmouth. The authori shall: (1) have the authority to work with oth port authorities and the federal government f business interchange; (2) establish additional

es; (3) appoint and compensate harbor masters; d (4) make such rules and regulations governing ots and harbor masters as it deems necessary. arruthers-Fla)
69-09869

OCEEDINGS TO ACQUIRE PROPERTY OR GHTS.

l Rev Stat Ann secs 371:1, 371:3, 371:4, 371:10, 1:17, thru 371:23 (1966), as amended, (Supp 67).

scriptors: *New Hampshire, *Public utilities, ompensation, *Permits, Eminent domain, Easents, Damages, Administrative agencies, Adnistrative decisions, Legislation, Water rights, te jurisdiction, Public rights, Riparian rights, nds, Streams, Shores, Legal aspects, Drainage, w control, Damsites, Bridges, Transmission es, Regulation.
ntifiers: Public Utilities Commission, Public ters.

construct transmission lines, towers, or elines, over, under or across any public waters this state a public utility must petition for and ure a permit from the Public Utilities Commisn. Public waters of this state are ponds of more n ten acres, tidewater bodies, and such streams the Commission may prescribe. The Commission ll hold a hearing for all interested parties to ermine if the permit may be exercised without ostantial interference with public rights in the ter bodies. The commission shall determine mpensation due land owners affected by the perts and due the state for the grant of rights to blic waters. Land owners may appeal the comnsation determination to the courts. A hearing ed not be held if all interested parties are in reement or if the permit is to furnish facilities to state. (Gadd-Fla)
69-09870

IDGES--LAYING OUT AND DISCONTINUG.

Stat Ann tit 19, secs 721, 722 (1968).

scriptors: *Vermont, *Bridges, *Jurisdiction, ocal governments, Regulation, Legislation, gal aspects, Bridge construction, Planning, Adnistration, Community development, Cost alloion.

nen a fine is assessed for failure to build a bridge tween two towns, each town pays in proportion the amount they were assessed for the building the bridge. However, the court must take into nsideration any amount already paid by the wn. Application to lay out, alter or discontinue a hway extending through two or more towns in ferent counties or for building a bridge between o such towns must be made to the Supreme urt which has the same power as the county rt in such matters when both towns lie in the ne county. (Johnson-Fla)
69-09871

PAIR AND MAINTENANCE OF BRIDGES.
Stat Ann tit 19, secs 1331-1340 (1968).

scriptors: *Vermont, *Bridges, *Local governnts, *Repairing, Administrative agencies, gislation, Government finance, Cost allocation, gal aspects, Administration, Public benefits, intenance, Maintenance costs, Highways, Adnistrative decisions.

y three citizens may give written notice that a dge is in a state of disrepair to a selectman of the wn in which the bridge is located. If repair on h bridge is not begun within thirty-six hours, h citizens may file for a hearing with the road nmissioners and, upon proper notice, a hearing l be held to determine whether or not the public good demands the repair of such bridge. The commissioners may order repair to begin themselves or order the town to initiate such action within thirty days. If the town fails to initiate the proper repairs, the commissioners will appoint an agent who will immediately repair such bridge. The town is liable for payment of the costs of such repair. When a bridge is between two counties or towns, both towns are jointly liable for the repair and maintenance of such bridge. (Johnson-Fla)
W69-09872

INJURY TO HIGHWAY BY DIVERTING STREAMS.
Vt Stat Ann tit 19, sec 1523 (1968).

Descriptors: *Vermont, *Highways, *Diversion, *Obstruction to flow, Legislation, Streams, Watercourses (Legal), Sluices, Lumber, Damages, Cities, Highways, Roads, Water law, Legal aspects, Transportation.
Identifiers: Penalties (Civil).

Any person who injures a public highway by obstructing or diverting a stream, watercourse or sluice, or by dragging logs or timber on the road surface, shall be fined $10 for each offense. Such person shall be liable also to the adjacent town for damage to the highway. (Shevin-Fla)
W69-09873

WATERWAYS, DRAINAGE, FLOOD CONTROL, WATER POLLUTION AND WATER RESOURCES STUDY COMM'N.
For primary bibliographic entry see Field 04A.
W69-09874

WATER TERMINALS.

Ill Ann Stat ch 19, secs 146-149 (Smith-Hurd 1963), as amended, (Supp 1969).

Descriptors: *Illinois, *Railroads, *Water management (Applied), *Construction, Construction costs, Administrative agencies, Leases, Rates, Contracts, Legislation, Land use, State jurisdiction, Administration, Rates, Cost allocation, Repairs, Maintenance, Maintenance costs, Equipment, Legal aspects.
Identifiers: *Water terminals.

The Department of Public Works and Buildings is directed to improve certain water terminal premises in Cook County. Plans may be prepared and contracts let for said improvements by the Department. The Atchison, Topeka and Santa Fe Railway shall be liable for the costs of such improvements not exceeding an aggregate $200,000 under a prior contract. The Department may lease, for periods not exceeding 10 years, portions of the improved property to any financially responsible person or corporation. Such lessees must agree to satisfactorily maintain the facilities, to pay a reasonable rent, and, in the case of private lessees, to furnish a bond to insure performance of the lease. The Department may not sell any part or all of said terminals, but may sell obsolete, used or excess materials and apparatus of any kind. (Kahle-Fla)
W69-09875

SUBMERGED LAND.

Ill Ann Stat ch 19, secs 150-151 (Smith-Hurd 1963).

Descriptors: *Illinois, *Beds, *Landfills, *Ownership of beds, Beds under water, State jurisdiction, Remedies, Legislation, Land use, Land tenure, State governments, Legal aspects, Relative rights, Land, Land reclamation, Land resources, Public benefits, Allotments.

The state of Illinois reclaims title to submerged state lands, land formerly submerged and illegally filled, and lands allotted to any person or corporation which have been illegally filled in or which are not used for purposes allotted. The attorney general is directed to bring such suits as are necessary in order to protect the people of the state and to recover such lands or protect such lands from encroachment or illegal occupation. (Kahle-Fla)
W69-09876

SEWAGE DISPOSAL.
For primary bibliographic entry see Field 05G.
W69-09877

DAVID MEYEROWITZ AND SON INC V 61 GREENPOINT AVE INC (ACTION TO RECOVER POSSESSION OF REAL PROPERTY).
300 NYS 2d 810-811 (1969).

Descriptors: *New York, *Bridges, *Boundary disputes, *Real property, Land tenure, Encroachment, Judicial decisions, Legal aspects, Relative rights, Water law.

Defendants were owners of a bridge and passageway which, as determined by the court, encroached upon plaintiff's property. The court ordered the bridge removed at defendant's expense. The defendants appealed. The appellate court held that the defendants could not use that portion of the bridge which encroached over plaintiff's property but reversed the lower court's ruling that the defendant must remove the bridge by further holding that the evidence as to ownership of the bridge was insufficient to prove that defendants owned it. (Shevin-Fla)
W69-09878

6F. Nonstructural Alternatives

PILOT PLANNING STUDY FOR AREA WIDE STORM DRAINAGE PLANNING.
Wright-McLaughlin Engineers, Denver, Colo.
For primary bibliographic entry see Field 04A.
W69-09774

MERRIMACK RIVER FLOOD CONTROL COMPACT.

NH Rev Stat Ann secs 487-A:1 thru 487-A:5 (1968).

Descriptors: *New Hampshire, *Administrative agencies, *Interstate compacts, *Interstate commissions, Legislation, Administration, Regulation, Water resources, Natural resources, State governments, Water policy, Dams, Flood control, Storage, Water resources development, Taxes.

New Hampshire enters into the Merrimack River Flood Control Compact with Massachusetts in order to promote interstate comity among and between the signatory states, to provide adequate storage capacity for impounding the waters of the Merrimack River and its tributaries, and to provide a joint and common agency through which the signatory states may effectively cooperate in accomplishing the object of flood control and water resource utilization in the Merrimack River basin. The Merrimack River Valley Flood Control Commission is created, the duties of which are enumerated herein. Agreements between New Hampshire and Massachusetts as to the sites of certain dams and reimbursement to New Hampshire by Massachusetts of lost tax moneys, economic losses, and damages occasioned by the provisions of the Compact, together with applicable procedural steps pertinent thereto are set forth. Compact notice and recording procedures as well as provisions for the appointment and compensation of flood control commissioners are set forth. (Moulder-Fla)
W69-09810

CONNECTICUT RIVER FLOOD CONTROL COMPACT.
NH Rev Stat Ann secs 487:1 thru 487:5 (1968).

Descriptors: *New Hampshire, *Interstate compacts, *Administrative agencies, *Interstate commissions, Legislation, Administration, Regulation, Water resources, Natural resources, State governments, Water policy, Dams, Flood control, Reservoirs, Storage, Water resources development, Taxes.

New Hampshire enters into the Connecticut River Flood Control Compact with Massachusetts, Connecticut, and Vermont in order to promote interstate comity, to assure adequate storage capacity for impounding the waters of the Connecticut River and its tributaries, and to provide a joint and common agency through which the signatory states may more effectively cooperate in accomplishing the object of flood control and water resource utilization in the Connecticut River basin. The Connecticut River Valley Flood Control Commission is created. The Commission's constitution, purposes, and duties are enumerated. Agreements between the signatory states as to reimbursement for taxes lost to political subdivisions due to agreements relating to construction of flood control dams and reservoirs by the federal government are included. The Compact is effective when ratified by Massachusetts, New Hampshire, Vermont, and Connecticut and approved by Congress. Compact notice and recording procedures as well as provisions for the appointment and compensation of commissioners are set forth. (Moulder-Fla)
W69-09811

6G. Ecologic Impact of Water Development

WATER RESEARCH PROGRAMS - AQUATIC COMMUNITIES,
Academy of Natural Sciences, Philadelphia, Pa. Dept. of Limnology.
Ruth Patrick.
US Dep Interior, Office of Water Resources Res Rep, Mar 1968. 22 p, 9 ref. OWRR Contract No 14-01-0001-1569.

Descriptors: *Reviews, *Ecology, *Ecosystems, Food chains, Productivity, Eutrophication, Water pollution effects, Lakes, Streams, Estuaries.
Identifiers: Aquatic ecosystems.

The present state of knowledge about the structure and functioning of aquatic ecosystems and how nutrients and energy are cycled through them is reviewed, and programs of research in these subjects are discussed. Knowledge as to the effects of various types of pollution on these ecosystems is discussed. Fields of research which need to be pursued in order to understand the structure and functioning of aquatic ecosystems are outlined. The kinds of basic studies needed in order to understand the effects of various types of pollution or perturbation, and how they can be diagnosed are discussed. Ways in which research in this important field should be implemented are suggested. (Knapp-USGS)
W69-09508

WATER POLLUTION IN REMOTE RECREATIONAL AREAS,
Forest Service (USDA), Duluth, Minn. Superior National Forest.
For primary bibliographic entry see Field 05G.
W69-09661

07. RESOURCES DATA

7A. Network Design

DETERMINING RAIN GAUGE DENSITIES IN ENGLAND FROM LIMITED DATA TO GIVE A REQUIRED PRECISION FOR MONTHLY AREAL RAINFALL ESTIMATES,
Imperial Coll. of Science and Technology, London (England). Dept. of Civil Engineering.
P. H. Herbst, and Elizabeth M. Shaw.
J Inst Water Eng, Vol 23, No 4, p 218-230, June 1969. 13 p, 4 fig, 2 tab, 7 ref.

Descriptors: *Rain gages, *Network design, *Statistical methods, Rainfall-runoff relationships, Gaging stations, Hydrologic data, Regional analysis.
Identifiers: *United Kingdom, Rain gage network density.

In demonstrating the analysis of rainfall observations from rain gauge networks in an attempt to determine the optimum densities required for given conditions, the selection of a range of catchments from different parts of England has produced results that reflect the variability of the precipitation pattern. It is obvious that the several statistics do not fit easily into simple relationships. From the foregoing discussion of the results, it might be suggested that the study of required network densities might produce more conformable figures if done on a regional basis. A t test on the 5 in. monthly rainfall line at 2.5% precision indicates that, for the relationship of the required gauge density to the long-term areal averages, there is only a 2.5% chance of this occurring by chance. Once a rain-gauge network has been installed and reliable observations are assembled, then the standard techniques of analysis are carried out. When a few years of data are available, checks on the quality can be made and tentative estimates of the station standard annual averages can be evaluated. A greater density of gauges than indicated in this study would be essential to assess daily areal precipitation, and to ensure the measurement of intense local storms. (Knapp-USGS)
W69-09673

7B. Data Acquisition

PRODUCTION OF ISOLATED PAIRS OF WATER DROPS HAVING UNEQUAL RADII,
National Center for Atmospheric Research, Boulder, Colo.
Charles E. Abbott.
The Rev Sci Instrum, Vol 40, No 9, p 1227-1230, Sept 1969. 4 p, 5 fig, 6 ref.

Descriptors: *Instrumentation, *Rainfall simulators, *Artificial precipitation, *Simulated rainfall, Laboratory tests, Rain.
Identifiers: Water-drop pair production, Raindrop interaction.

To extend laboratory investigations of the effects of electric charges and fields on colliding water drops, a technique has been developed for simultaneously producing pairs of drops with unequal radii. Radius ratios as large as 10 to 1 can be obtained with drops having radii in the range 0.1-1 mm. Continuous production of drop pairs is possible, with the desired repetition rates selected by electronic controls and unwanted drop pairs deflected out of the observation volume. Successive pairs, thus produced, are sufficiently identical that a sequence of photographs has been obtained with an effective elapsed time between exposures of 100 microsec, the equivalent of 10,000 frames/sec in terms of high speed photography. (Knapp-USGS)
W69-09448

CARBON-14 IN PATAGONIAN TREE RINGS,
Groningen Rijksuniversiteit (Netherlands). Physics Lab.
J. C. Lerman, W. G. Mook, J. C. Vogel, and H. de Waard.
Science, Vol 165, No 3898, p 1123-1125, Sept 12 1969. 3 p, 2 fig, 18 ref.

Descriptors: *Paleoclimatology, *Radioactive dating, *Carbon radioisotopes, *Dendrochronology, Carbon cycle, Trees, Plant growth, Quaternary period.
Identifiers: Patagonia, Atmospheric radioactivity.

The radiocarbon activity found in tree rings from southern Argentina shows secular fluctuations which are synchronous with and of the same amplitude as those known for the Northern Hemisphere. Comparable measurements indicate that the activity in Patagonian trees is about five per m lower than in European trees. (Knapp-USGS)
W69-09450

A COMBINED CONTROL-METERING SECTION FOR GAGING LARGE STREAMS,
Forest Service (USDA), Flagstaff, Ariz. Rocky Mountain Forest Range Experiment Station.
Harry E. Brown.
Water Resources Res, Vol 5, No 4, p 888-894, Aug 1969. 7 p, 7 fig, 2 ref.

Descriptors: *Stream gages, *Instrumentation, *Discharge (Water), Streamflow, Weirs, Flumes, Gages, Depth, Watershed management, Flow measurement, Water control, Water levels, Stage-discharge relations.
Identifiers: Stream metering structures.

Two stream gaging stations of new design were constructed and tested on the Beaver Creek pilot watershed in Arizona. The gage provides a stable stage discharge relations with sufficient precision for long-term hydrologic investigations. The control surface is a concrete slab 15 ft wide with a 6 inch triangular lip built into the downstream edge. Flow is metered on the concrete surface near the upstream edge of the slab. Capacity of the gage is in excess of 1000 cfs; field ratings up to 705 cfs are presented. (Knapp-USGS)
W69-09471

THERMAL AND ELECTRICAL CONDUCTIVITIES OF SANDSTONE ROCKS AND OCEAN SEDIMENTS,
Oregon State Univ., Corvallis. Dept. of Oceanography; and National Academy of Sciences-National Research Council, Washington, D.C. Div. of Earth Sciences.
For primary bibliographic entry see Field 02F.
W69-09498

MEASUREMENT OF SAND TRANSPORT IN RIVERS WITH SPECIAL REFERENCE TO TRACER METHODS,
Hydraulics Research Station, Wallingford (England).
For primary bibliographic entry see Field 02J.
W69-09507

MOTION MEASUREMENT BY LASER DOPPLER TECHNIQUES,
Case Western Reserve Univ., Cleveland, Ohio; and National Aeronautics and Space Administration Cleveland, Ohio. Lewis Research Center.
John C. Angus, David L. Morrow, and John W. Dunning, Jr.
Ind Eng Chem, Vol 61, No 2, p 8-20, Feb 1969. 1 p, 14 fig, 1 tab, 112 ref.

Descriptors: *Laser, *Velocity meters, Measuring instruments, Light waves, Optical instruments, Motion, Bibliographies, Molecules, Laminar flow, Instrumentation, Fluid flow, *Flowmeters, *Flow measurement, Hydraulics, Physics, Vibrations.
Identifiers: Doppler effect, Light beams, Light scattering method, Brownian movement.

Velocity measurements may be made by detecting the Doppler shift of laser light scattered from

ving object. The paper discusses laser Doppler
ocity meters for measuring the motion of fluids
nacroscopic objects and methods for determin-
molecular motions. The most important present
lications include fluid flow measurements,
ration analysis, and transport property measure-
nts in fluids. Potential applications include mea-
ement of particle size distribution, chemical
ction rate constants, and velocity sensing for au-
atic control devices. The method may find
earch uses in crystal nucleation and growth stu-
s, emulsion polymerization, measurement of
ctra and correlation functions in turbulent flow,
studies of conformations of macromolecules in
ution. The method is accurate, almost instan-
eous, does not disturb the system being mea-
ed, has a high spatial resolution, and can mea-
e velocities as low as 0.001 cm/sec. (USBR)
9-09526

APEZOIDAL FLUMES FOR MEASURING
OW IN IRRIGATION CHANNELS,
ricultural Research Service, Kimberly, Idaho.
R. Robinson.
ARS 41-140, Agr Res Serv, Mar 1968. 15 p, 8
6 tab, 3 ref, append.

scriptors: *Flumes, *Flow measurement,
ischarge measurement, Head loss, *Water mea-
ement, Energy losses, Hydraulics, Irrigation
als, Ditches, Parshall flumes, Comparative
efits, Canals, Unlined canals, Channels, Sub-
rgence, Slopes.
ntifiers: *Trapezoidal flumes, Submerged flow,
e flow, Lined canals, Rectangular channels.

pezoidal flumes are superior to rectangular or
rshall-type flumes for measuring small flows.
ese flumes can be constructed as an integral part
a lined canal or made of metal, fiberglass, or
od and installed in the channel. The shape con-
ms to the normal shape of lined or unlined
ches. The trapezoidal shape is desirable because
width of water surface increases as the depth in-
ases. This means that one structure can convey
rger range of flow; the entire range of depth for
iven range of discharge is smaller. Operational
aracteristics of trapezoidal flumes are superior
ause less backwater will result and a shallower
tion will be required than for a rectangular
pe. Another desirable feature of the trapezoidal
ne is the flat bottom throughout rather than a
pped section as in the Parshall flume. No par-
lar advantage of a crest section with a drop in
floor such as in the Parshall flume has been
nd. Submergence to a maximum of 80% can be
wed before corrections are necessary. For flows
h submergence in excess of 80%, flow cor-
tions can easily be made. The total head loss
ough the trapezoidal structure may be less for
nparable discharges than for the Parshall flume.
SBR)
9-09532

RIAL PHOTOGRAPHS FOR OPERATIONAL
REAMFLOW FORECASTING IN THE
LORADO ROCKIES,
est Service, Fort Collins, Colo.
rles F. Leaf.
, 37th Annu Meet, West Snow Conf, Salt Lake
, Utah, Apr 1969. 16 p, 12 fig, 2 tab, 8 ref.

criptors: *Aerial photography, *Runoff,
owmelt, Hydrologic data, *Snowpacks, Snow
eys, *Runoff forecasting, *Streamflow
casting, Hydrology, Small watersheds, Op-
m use, Hydrographs, *Rocky Mountain Re-
, Colorado.
ntifiers: *Rocky Mountains, Fraser Experimen-
Forest, Colo.

diction and simulation of runoff from snowmelt
important to the economic and efficient opera-
of engineering systems supplying and con-
ing water. In 1964, the Forest Service initiated
ogram to collect snow cover data on a routine
s. Low-level air photos, supplemented by ground observations, were used to observe the areal extent of snow cover at about 10-day intervals after snow melt began. Results from 3 small watersheds in the Fraser Experimental Forest, Colo, are discussed. Each of the 3 watersheds has a characteristic functional relationship between the extent of snow cover during the melt season and accumulated runoff. Observed year-to-year deviations may have physical significance that can be explained by differences in initial snowpack water equivalent, soil moisture requirements, and meteorological conditions during snowmelt. Subjective interpretation of the photos may account for much of the scatter around mean curves. Importance of snow cover information in various streamflow forecasting methodologies justifies continued research to develop more objective techniques for accurately obtaining this type of information from aerial photographs. Several more years of record are needed so that the entire range of hydrologic conditions at various stages of snowpack depletion are sampled. (USBR)
W69-09539

A 2-YEAR EVALUATION OF THE SNOWMELT LYSIMETER,
Forest Service (USDA), Moscow, Idaho.
Harold F. Haupt.
Pap, 37th Annu Meet West Snow Conf, Salt Lake City, Utah, Apr 1969. 8 p, 4 fig, 2 tab, 6 ref.

Descriptors: *Lysimeters, Snow management, *Snowmelt, Snowpacks, Melt water, Rainfall, Runoff, Hydrologic instruments, Measuring instruments, Instrumentation, Runoff forecasting, Evaluation, Hydrology, Maintenance costs, Costs, *Snow.

The Forest Service operated a snowmelt lysimeter during the 1966-67 and 1967-68 winters at the Priest River Experimental Forest in northern Idaho. The lysimeter has a surface area of 2.72 sq ft and measures the outflow from the base of a column of undisturbed snow. Direct measurements are provided for melt output during clear weather and rain percolate plus melt during rainy periods; the lysimeter does not provide continuous assessment of snow input or water equivalent of the snowpack. The apparatus consists of a catchment trough with an outlet drain, an underground drain hose, and a catchment tank and recorder system. The operation of the installation is described and results are given. The lysimeter is low in construction and maintenance costs, is accurate, and there is practically no loss of records from malfunctions. (USBR)
W69-09545

INSTRUMENTATION FOR HYDRAULIC MEASUREMENTS IN LABORATORY AND FIELD STUDIES,
Bureau of Reclamation, Denver, Colo.
J. C. Schuster.
Bur Reclam Rep No Hyd-592, May 1969. 29 p, 4 fig, 3 tab, 25 photo.

Descriptors: Hydraulics, *Instrumentation, Measurement, Conductivity, *Measuring instruments, Temperature, Pressure, Velocity meters, Pressure sensors, Hydraulic conductivity, *Recording systems, Velocity, Hydraulic models, *Laboratory equipment, Pressure measuring instruments, Hydraulic transients, *Hydraulic equipment, Hydraulic engineering.
Identifiers: Instrument transformers, Analog instruments, Analog-to-digital converter, Pressure transducers.

Photographs and descriptive captions of instruments are presented to indicate some possible instrumentation systems used by the Hydraulics Branch of the Bureau of Reclamation. The described instrument combinations are not exhaustive, but show the capabilities of instruments purchased on a modest budget. One motive for selecting this equipment was the interchangeability of components. An instrumentation system assembled for a particular study may be reassembled into other systems for different investigations. The equipment includes measurement and recording systems for pressure, electric conductivity, temperature, velocity distribution, flow tracing, boundary shear, surge waves, wave height, and analog-to-digital conversion. (USBR)
W69-09546

A GUIDE TO THE GENERATION OF LIAPUNOV FUNCTIONS,
International Business Machines Corp., New York; and Princeton Univ., N.J.
For primary bibliographic entry see Field 08B.
W69-09554

TECHNIQUES OF HYDROLOGIC RESEARCH IN FORESTED PEATLANDS, U.S.A.,
Forest Service (USDA), Grand Rapids, Minn. North Central Forest Experiment Station.
Roger R. Bay.
XIV IUFRO Congress, Munich, Vol 1, p 400-415, 1967. 6 p, 4 fig, 4 tab, 19 ref.

Descriptors: *Bogs, *Swamps, *Instrumentation, *Watersheds (Basins), Water measurement, Demonstration watersheds, Hydrogeology, Water table, Streamflow, Stream gages, Forestry, Organic soils, Minnesota.
Identifiers: *Bog hydrology, *Peatlands, *Forested watersheds, Wetland hydrology.

The hydrology of bog watersheds in the northern United States is being studied with controlled field experiments utilizing the calibrated watershed approach. Although this technique has been used on upland and mountainous watersheds it has rarely if ever been used in studies of peatland hydrology. Research techniques and instrumentation have been modified or developed to cope with unusual problems in peatlands. Groundwater wells in the study bogs and hydrogeologic investigations on the surrounding watershed area have proven invaluable in the interpretation of bog water table fluctuations and bog groundwater relationships. During the pre-treatment period, precipitation, runoff, and groundwater data collected on six experimental bogs have already yielded important information on the hydrology of natural, forested bog watersheds. Laboratory and field experiments in organic soils have also provided new information on the physical properties of peat materials. Data on water retention and hydraulic conductivities of peats in situ have explained water table reactions to precipitation input and evapotranspiration output under natural conditions. These data should also help explain land treatment effects, and aid in the extension of hydrologic principles to other peatland complexes.
W69-09571

IMPORTANCE OF VOLUMETRIC EXPRESSION OF WATER CONTENTS OF ORGANIC SOILS,
Forest Service (USDA), Grand Rapids, Minn. North Central Forest Experiment Station.
For primary bibliographic entry see Field 02G.
W69-09575

PLANNING AND INTERPRETING SOIL PERMEABILITY MEASUREMENTS,
Agricultural Research Service, Phoenix, Ariz., Water Conservation Lab.
For primary bibliographic entry see Field 02G.
W69-09658

INFERENCE OF STRATOSPHERIC TEMPERATURE AND MOISTURE PROFILES FROM OBSERVATIONS OF THE INFRARED HORIZON,
GCA Corp., Bedford, Mass.
For primary bibliographic entry see Field 02B.
W69-09659

AN INTERFACE PROBLEM WITH A SOURCE AND A SINK IN THE HEAVY FLUID,
Technische Hogeschool, Delft (Netherlands).
For primary bibliographic entry see Field 02L.
W69-09668

A PREFABRICATED FLAT-VEE WEIR FOR EXPERIMENTAL CATCHMENTS,
Durham Univ. (England). Dept. of Geography.
K. Smith, and M. E. Lavis.
J Hydrol, Vol 8, No 2, p 217-226, June 1969. 10 p, 3 fig, 11 ref.

Descriptors: *Weirs, *Discharge measurement, *Flow measurement, Streamflow, Runoff, Flowmeters, Gages, Gaging stations, Discharge (Water), Stream gages.
Identifiers: Portable weirs.

The choice and method of construction of a prefabricated flat-vee weir designed to operate in a small upland catchment are described. The considerations outlined are directly related to the conditions imposed by the upland environment, but such a structure will be of general application where there is a need for an accurate but relatively cheap portable and easily installed structure for short-term hydrological studies in experimental basins. (Knapp-USGS)
W69-09670

CALIBRATING A WATERSHED BY USING A CLIMATIC DATA,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 02A.
W69-09759

A METHOD OF ESTIMATING STREAMFLOW LOSS BY EVAPOTRANSPIRATION FROM THE RIPARIAN ZONE,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 02D.
W69-09760

7C. Evaluation, Processing and Publication

AN ASSESSMENT OF THE NATION'S WATER RESOURCES,
Water Resources Council, Washington, D.C.
For primary bibliographic entry see Field 06B.
W69-09452

CHARACTERISTIC RESPONSE TIMES IN DESIGN FLOOD ESTIMATION,
New South Wales Univ., Kensington (Australia); and Ministry of Public Works (Cambodia).
For primary bibliographic entry see Field 02E.
W69-09667

POTENTIAL EVAPOTRANSPIRATION AND CLIMATE IN ALASKA BY THORNTHWAITE'S CLASSIFICATION,
Pacific Northwest Forest and Range Experiment Station, Juneau, Alaska. Inst. of Nothern Forestry; and State Univ., of New York, Syracuse. Dept. of Watershed Management.
For primary bibliographic entry see Field 02D.
W69-09698

UNSTEADY FLOW SIMULATION IN RIVERS AND RESERVOIRS,
Tennessee Valley Authority, Knoxville.
Jack M. Garrison, Jean-Pierre P. Granju, and James T. Price.
Journal of the Hydraulics Division, ASCE, Vol 95, No HY5, Proc Paper 6771, p 1559-1576, Sep 1969. 18 p, 12 fig, 1 tab, 2 append.

Descriptors: *Unsteady flow, *Simulation, Rivers, Reservoirs, Transient flow, Hydraulics, Computers, *Open channels, Waves, Field measurements.
Identifiers: *Stream channels, Turbine operations, Tennessee Valley, Water flow, *TVA.

A digital computer program for solving the basic equations of unsteady flows in reservoirs and natural rivers is being used by the TVA to solve a variety of open-channel flow problems. The mathematical model, which has been proven with field measurements is capable of accurately predicting variations in water surface elevations, mean velocities, and flows with respect to time at any point along a stream.
W69-09725

DIGITAL COMPUTER SIMULATION OF TRANSIENT FLOWS IN THE TVA SYSTEM,
Tennessee Valley Authority, Knoxville.
For primary bibliographic entry see Field 08B.
W69-09726

STOCHASTIC PROGRAMMING: A SURVEY,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 06A.
W69-09772

ASPECTS OF WATER RESOURCES LAW IN MINNESOTA,
Minnesota Univ., Minneapolis. Water Resources Research Center.
For primary bibliographic entry see Field 06E.
W69-09794

STATE JUDICIAL CLASSIFICATIONS OF WATER AND STATE JUDICIAL DETERMINATION OF RIGHTS IN NATURAL SURFACE WATERCOURSES,
Minnesota Univ., Minneapolis. Water Resources Research Center.
For primary bibliographic entry see Field 06E.
W69-09795

08. ENGINEERING WORKS

8A. Structures

NEW TECHNIQUES OF RECLAMATION CONSTRUCTION,
Bureau of Reclamation, Denver, Colo.
B. P. Bellport.
Prepr 826, Amer Soc Civ Eng Annu Nat Meet Water Resour Eng, New Orleans, La, Feb 1969. 43 p, 9 fig.

Descriptors: *Construction, Creativity, Construction equipment, Earth handling equipment, Tunneling machines, Pumping plants, Aesthetics, Soil cement, Shafts (Excavations), Blasts, Excavation, Photogrammetry, Cross-sections, Tunnel construction, Aerial photography, Critical path method, Safety, Borehole cameras, Specifications, Value engineering.
Identifiers: Innovation, *Bureau of Reclamation, Radial jacking tests, *Construction methods, *Cost savings.

New techniques being employed in constructing Bureau of Reclamation structures and facilities in the 17 Western States are described. Some Bureau efforts for advancing the administration of construction contracts through improvements in specification provisions are discussed. New advances in construction safety and research activities that will influence developing new construction techniques are reviewed. In meeting future challenges, the engineering profession and construction industry must devise new construction techniques to accomplish work economically and expeditiously, and use their technologies and experience to provide an improved environment reflecting the relationship of man to his needs and the high standard of living enjoyed in this country. The reso
cefulness and skills of engineers and contract
will be challenged as water resources projects gr
in magnitude and complexity and as the Natio
needs for water continue to mount. (USBR)
W69-09522

EFFECT OF OPENINGS ON DESIGN OF SU
SURFACE DRAINS,
Ohio State Univ., Columbus; and Iowa State Un
of Science and Technology, Ames.
Glenn O. Schwab, Darrell W. DeBoer, and Howa
P. Johnson.
Proc Amer Soc Civ Eng, J Irrig Drain Div, Vol
No IRI, p 199-209, Mar 1969. 11 p, 6 fig, 17 re
append.

Descriptors: *Subsurface drains, Draina
*Drainage systems, Drainage engineering, Drai
Effects, *Drain tiles, Water table, Drawdo
Flow, Inflow, Outflows, Bibliographies, Joi
(Connections), Joints, *Slots, Tile drains, Porosi
Identifiers: Drain holes, *Openings, *Open drai
*Holes, Drawdown curves, Effect, *Perforatio
Inflow-outflow measurement, Spacing.

Theoretical effects of joint spacing and of perfo
tions on flow into 1-ft lengths of drain tile
presented. Results show relative inflow rates
the effect on water table drawdown for 6-in.-
drains 4 ft deep. Field results show that
theoretical effect of joint spacing can be applied
the drawdown case if the water table midw
between the drains is at least 2 ft above the cen
of the drain tile. The studies also provided so
verification of the theory applicable to perfo
tions. Spacings of perforations on the cylindri
surface of a drain has little effect on inflow wh
the ratio of shortest to longest spacing is grea
than 0.2. Uniform spacing is recommended. Fr
data presented, the effect on water table drawdo
can be estimated for perforations or joints and
effect of a combination of joints and perforatio
can be approximated. A desired increase in fl
may be obtained by adding perforations or by
creasing the joint spacing on short lengths
drains. For a given drainage rate, depth, and dian
ter of drain, increasing the joint spacing (or p
forations) increases the drawdown rate. The eff
of joint spacing on drawdown rates increases as
drain spacing and soil porosity decrease. (USBR
W69-09533

EARTH PRESSURES ON OTTAWA-OUTFA
SEWER TUNNEL,
National Research Council of Canada, Otta
(Ontario).
W. J. Eden, and M. Bozozuk.
Can Geotech J, Vol 6, No 1, p 17-32, Feb 1969.
p, 10 fig, 6 ref.

Descriptors: *Earth pressure, *Sewers, Tun
design, *Tunnel pressures, Tunnel linings, Tunn
Overburden, Overconsolidation, Clays, S
mechanics, *Soil pressure, Foreign design pr
tices, Pore water pressures, Piezometers, *Set
ment, Instrumentation.
Identifiers: Piezometric head, Canada, Press
cells, Leda clay, Ottawa sewer plant.

Measurements of surface settlement, changes
piezometric levels, and earth pressures were m
on a 10-ft-dia tunnel in Ottawa, Canada. The t
nel passes through extremely sensitive
moderately overconsolidated Leda clay. The
strumentation is described, and results are given
a period covering 1 yr before construction to
after completion. Results are compared with m
surements on a similar tunnel in Detroit clay. M
surements were made on a flexible temporary s
lining and on the rigid permanent reinfor
concrete lining. Very little surface settlement
measured because of overconsolidation in the
and the construction method. The tunnel acts
drainage sink and influences the piezome
regime in the clay. Earth pressures agreed
previous tunnel measurements, showing that ve

pressures approach the full overburden pres-
e. (USBR)
9-09536

IDGES OVER STATE BOUNDARY LINE
REAMS.
primary bibliographic entry see Field 06E.
9-09634

3. Hydraulics

RESHOLD PRESSURE PHENOMENA IN
ROUS MEDIA,
illips Petroleum Co., Bartlesville, Okla.; and
chigan Univ., Ann Arbor.
primary bibliographic entry see Field 02F.
9-09504

ODEL STUDIES OF AN ARMOURED
CKFILL OVERFLOW DAM,
ernational Engineering Co., Inc. San Francisco,
lif.
S. Sarkaria, and Burton H. Dworsky.
ter Power, Vol 20, No 11, p 455-462, Nov
68. 8 p, 13 fig, 6 ref.

scriptors: *Rockfill dams, *Spillways, Model
ts, Gradation, Earth dams, *Model studies,
ydraulic models, *Slope protection, Scour, Test
cedures, Seepage, Safety factors, Pressure head,
ned embankments, Filters, Erosion control, Tail-
ter.
ntifiers: *Overtopping, Piping (Erosion), Self-
llway dams.

draulic model studies were conducted for a
posed armored overflow embankment of an af-
bay regulation dam on the Yuba River, Calif.
nning studies indicated that substantial
nomic advantages would result from using the
erflow embankment in lieu of a conventional
ncrete spillway. Armor protection for the crest
d downstream face will prevent surface erosion
the embankment during overtopping. Armor
tection for the apron, in conjunction with a high
tural tailwater, will prevent scour of the tailrace
annel at the toe of the dam during overtopping.
epage pressures that develop when the entire
charge occurs through the dam during periods of
novertopping streamflow are less than critical,
l will not produce flotation of material at the
wnstream toe of the dam. Seepage pressures in
embankment during periods of overtopping
charges are not excessive and will probably not
duce flotation of material near the downstream
e of the dam. Suitable gradation of materials
hin the zoned embankment will prohibit the in-
tion of piping at the interfaces of the zones.
SBR)
9-09531

FLUENCE OF LINE MOTION ON WATER-
MMER PRESSURES,
ntucky Univ., Lexington.
J. Wood.
c Amer Soc Civ Eng, J Hydraul Div, Vol 95, No
3, p 941-959, May 1969. 19 p, 15 fig, 1 tab, 19
2 append.

criptors: *Structural analysis, *Pipe flow,
elines, *Water hammer, *Hydraulics, Surges,
id flow, Hydraulic transients, Wave action,
draulic valves, Fluid friction, Closing, Pressure,
tion, Bibliographies.
ntifiers: Pressure waves, Transient flow,
alytical method.

ge pressure increases following rapid valve clo-
s in liquid flow pipe systems produce forces
must be resisted by the system structure. These
es produce pipeline motion, usually of small
plitude and generally ignored in water hammer
lysis. The motion may produce pressures that
er significantly from those predicted using
lly supported pipelines. Initial pressure surges having magnitudes greater than 20% above the commonly used maximum for instantaneous valve closure may result under certain combinations of structural parameters and closing conditions; subsequent surges can be much greater than the initial surge. Under other conditions, the pressure buildup is retarded significantly and the line motion can be used to control water hammer pressures. Line motion associated with water hammer surge can produce characteristics such as pressure overshoot and jagged portions of the pressure trace that have often been observed experimentally. (USBR)
W69-09550

DESIGN OF ROUGHNESS ELEMENTS FOR ENERGY DISSIPATION IN HIGHWAY DRAINAGE CHUTES,
Virginia Polytechnic Inst., Blacksburg.
Henry M. Morris.
Highw Res Rec, No 261, p 25-37, 1969. 13 p, 5 fig, 15 ref.

Descriptors: *Energy dissipation, *Roughness (Hydraulic), Field tests, *Chutes, *Channels, Channel flow, Hydraulic jump, Hydraulic design, Flow control, Turbulent flow, Spillways, Laboratory tests, Hydraulic models, Bibliographies, Roughness, Hydraulic structures, Stilling basins.
Identifiers: (Energy dissipators, Roughness projections, Chute blocks, Channel design, Spillway profiles, Critical velocity.

A recurring need in hydraulic engineering is a simple, reliable method for dissipating excess energy in storm water flowing down steep drainage channels. This problem has been handled by some form of stilling basin at the channel outlet. An alternate method is the provision of roughness elements in the channel. Such elements can be designed to produce the phenomenon of tumbling flow in the channel. This is a cyclically uniform flow consisting of a series of hydraulic jumps and overfalls, assuring that the channel outlet velocity will not exceed the known critical velocity for the given discharge. Laboratory and field studies have been conducted to develop design criteria for this method of energy dissipation. The study indicates that either 2-dimensional square elements or cubical elements should be used. Design equations and recommendations for spacing and placing elements are presented. (USBR)
W69-09552

A GUIDE TO THE GENERATION OF LIAPUNOV FUNCTIONS,
International Business Machines Corp., New York; and Princeton Univ., N.J.
Okan Gurel, and Leon Lapidus.
Ind Eng Chem, Vol 61, No 3, p 30-41, Mar 1969. 12 p, 1 fig, 1 tab, 69 ref.

Descriptors: Mathematics, *Mathematical analysis, *Differential equations, *Stability analysis, Dynamics, Reviews, Matrix algebra, Bibliographies, Transformations, Nonlinear systems, Optimization, Equations, *Control systems, Automatic control, Analytical techniques, Systems analysis.
Identifiers: *Liapunov theorem, Dynamic equilibrium, Eigenvalues.

Liapunov's direct method of stability analysis treats the stability of ordinary differential equations and tries to answer the question of whether the solution remains arbitrarily close to an equilibrium solution after being disturbed. The analysis is accomplished by the Liapunov function and its total derivative which is examined for certain properties. The theorems for Liapunov's method are discussed; methods for constructing the functions are described. Use of this method for analyzing a specific physical system requires in-depth searching of the literature in many diverse fields to ascertain recent developments. This paper enables a novice to approach the literature in a rational manner. (USBR)
W69-09554

SUCCESSFUL SAND CONTROL DESIGN FOR HIGH RATE OIL AND WATER WELLS,
Signal Oil and Gas Co., Los Angeles, Calif.
For primary bibliographic entry see Field 02J.
W69-09649

TRANSIENT FUNCTIONS FOR LAND DRAINAGE,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
For primary bibliographic entry see Field 02F.
W69-09654

WELL CAPACITY FOR CONTINUOUS PERMEABILITY VARIATION,
Northwestern Univ., Evanston, Ill., Technological Inst.; and Soil Testing Espanola, Madrid.
R. J. Krizek, W. H. Baker, and A. G. Franklin.
ASCE Proc, J Irrig and Drainage Div, Vol 95, No IR3, Pap 6785, p 409-414, Sept 1969. 6 p, 1 fig, 2 ref, append.

Descriptors: *Water wells, *Specific capacity, *Permeability, *Groundwater movement, *Mathematical studies, Model studies, Mathematical models, Drawdown, Flow, Porous media, Anisotropy, Artesian wells, Water yield.
Identifiers: Fracturing (Aquifers), Acid treatment (Aquifers).

The results of an analysis of the relative effects of continuous, radially symmetric permeability variations on the capacity of a single artesian well are graphically presented. Such variations may result from acid treatment, fracturing, effects incident to mud-drilling, or from structural alterations in soil adjacent to a well. The change in permeability was assumed to be maximum at the well face and to decrease exponentially in a radial direction away from the well axis. The resulting equation for relative well capacity was integrated numerically for various cases to yield a family of curves which, together with estimates of the altered and original permeability values and of the radial extent of the permeability change, can be used to quickly obtain estimates of well performance. (Knapp-USGS)
W69-09656

UNSTEADY FLOW SIMULATION IN RIVERS AND RESERVOIRS,
Tennessee Valley Authority, Knoxville.
For primary bibliographic entry see Field 07C.
W69-09725

DIGITAL COMPUTER SIMULATION OF TRANSIENT FLOWS IN THE TVA SYSTEM,
Tennessee Valley Authority, Knoxville.
B. J. Buehler, Jack M. Garrison, J. P. Granju, and J. T. Price.
Proceedings Vol 1 (Subject A) Thirteenth Congress of the International Association for Hydraulic Research, Kyoto, Japan, p A38-1--A38-8, Sep 1969. 8 p, 4 fig, 1 tab.

Descriptors: Unsteady flow, *Simulation, Rivers, Reservoirs, *Transient flow, Hydraulics, Computers, *Open channels, Waves, Field measurements.
Identifiers: *Stream channels, Turbine operations, Tennessee Valley, Water flow, *TVA.

During the past 2 years major advances have been made by TVA using the digital computer to solve the basic differential equations describing the transient behavior of water in open channels. TVA's mathematical model uses an explicit scheme to compute discharge, stage, and velocity transients from known boundary and initial conditions. In this scheme, finite difference representations of the differential equations of continuity and motion are solved. Stage, flow, or rating curve boundary conditions, local inflows, variable roughness along the channel, and actual channel geometry can be used. Steady or transient flows and stages along the channel may be given for initial conditions. Results from four studies show the diverse range over which the model has been applied. These are two reservoirs, a

natural river, and an uncontrolled canal connecting two reservoirs. Calculated results and field measurements are in excellent agreement in each of the four cases. Once verified the mathematical model becomes an invaluable tool for predicting the transient response to any type of operation.
W69-09726

8C. Hydraulic Machinery

BEHAVIOR OF TURBINE PUMPS OF HIGH POWER OR HIGH SPECIFIC SPEED DURING START-UP,
D. Florjancic, and D. Hartland.
Ver Deut Ing Ber Nr 75, p 27-36, 1964. Transl from Ger, Bur Reclam Transl 813, June 1969. 29 p, 20 fig.

Descriptors: *Pump turbines, *Hydraulic machinery, Pumps, Model tests, Hydraulic turbines, Compressed air, Turbine parts, Turbine runners, Model studies, Guide vanes, Investigations, Design, Foreign research, *Specific speed, Behavior.
Identifiers: Germany, Foreign testing, *Starting, Reversible turbines.

A survey of problems occurring during startup of reversible turbine pumps is given and procedures for limiting power input to the pump motor are described. Cause and magnitude of heavy alternating loads on guide vanes are described with reference to startup, emergency situations, and abnormal operating conditions. If water is depressed in a pump to reduce power consumption during startup, the greatest problems in power control occur as the pump is being rewatered. If adequate steps are not taken to control the movement of the increasing quantity of water in the pump, extremely rapid rise in power consumption can occur. The flow of water within a filling pump can be controlled by: (1) baffles designed to break up circular movements, (2) gates positioned between the suction tube and runner to prevent axial exchange-flow, (3) variation of the density of the medium by aerating, or (4) installation of turbulence jets to produce favorable flow characteristics in the suction tube. Measures to handle cases involving flow interruption during pumping or the transition from pump to turbine operation were considered. Results of model tests, suggestions for relieving startup problems, and the history of pump turbine technology are given. (USBR)
W69-09519

WASHING INSULATORS ON 500-KV LINES IS FOUND MOST EFFECTIVE,
Pacific Gas and Electric Co., San Francisco, Calif.
W. H. Zalabak.
Transm Distrib, Vol 21, No 5, pp 150-152, May 1969. 2 p, 4 fig.

Descriptors: *Power operation and maintenance, *Electrical insulators, *Contamination, Atmospheric pollution, *Transmission lines, Costs, Extra high voltage, Maintenance, Economies, High pressure, Safety.
Identifiers: *Live line maintenance, Contaminants, *Washing.

Experiences with transmission on the Pacific Gas and Electric Co system in California, indicated that the new 500-kv lines would require removal of insulator contamination, particularly true of installations in coastal areas where equipment is exposed to airborne salt and industrial contamination. Past experiences proved that energized line washing is the most economical method of removing contamination. Studies were made on the 500-kv lines in the Moss Landing area to determine whether washing or applying silicon grease would prove more economical. The study showed that over $200 per yr per tower could be saved by hotwashing. Rules covering the more critical points and several common sense rules were established for the safety of personnel when washing energized lines.
W69-09529

EFFECT OF SPECIFIC SPEED ON CENTRIFUGAL PUMP OPERATING CHARACTERISTICS,
Worthington Corp., Harrison, N.J.
Raymond A. Kugelman.
Water Wastes Eng, Vol 6, No 3, p B-24-B-27, Mar 1969. 4 p, 9 fig.

Descriptors: *Centrifugal pumps, *Pumps, Design, *Specific speed, Curves, Hydraulic machinery, Efficiencies, *Characteristics, Hydraulic design, Mixed flow pumps, Propeller pumps, Limiting factors, impellers, Pump testing.

Operating limitations of centrifugal pumps are occasionally dictated by the mechanical design. The prime reason for these limitations lies in the influence of the specific speed of the pump on operating conditions. The term specific speed does not refer to speed, but is an index number that classifies each pump. Specific speed establishes: (1) the shapes of the head-capacity, power-capacity, and efficiency-capacity curves; (2) the maximum efficiency that the pump will attain; and (3) the configuration of the impeller and all hydraulic passages. These characteristics determine the operating capabilities of the pump. Effects of specific speed on pump operating characteristics are discussed. (USBR)
W69-09538

HYDROELECTRIC GENERATING PLANTS AND PROJECTS.
For primary bibliographic entry see Field 06E.
W69-09637

PROBLEMS OF LARGE WATERWHEEL GENERATORS,
Westinghouse Electric Corp., East Pittsburgh, Pa.
E. C. Whitney.
Pap, Amer Power Conf, Chicago, Ill, Apr 1969. 4 p.

Descriptors: *Electric generators, *Hydroelectric power, Design, *Electrical design, Stators, Rotors, Thrust bearings, Thermal expansion, Magnetic fields, Manufacturing, Faults (Electrical), Electric relays, Temperature, Centrifugal forces, Erection, Maintenance, Handling equipment, Excitation, Voltage regulators, *Generators.
Identifiers: *Electric machinery, Air gaps, Protection (Electrical), Temperature rise.

Future problems likely to be encountered in designing and constructing large waterwheel generators are discussed, using as a guide the past experience gained from manufacturing machines rated 220,000 kva/261,000 hp, 225 rpm, 60 deg C rise, and designing 615,385-kva machines. On any large generator having a rotor diameter in excess of 50 ft, thermal expansion of the stator and rotor must be controlled so that the stator will remain concentric with the rotor, even though the time sequence of expansion of the stator is not the same as for the rotor. The magnetic pull in large machines may cause buckling of the stator punchings; when thermal expansion forces are combined with the magnetic pull, the problem is amplified. Stator sole plates must withstand frictional effects of thermal expansion and short circuit torques. Present methods used for differential and split phase protection must be improved. Mechanical problems, handling, excitation, and bearing design require special consideration when designing large waterwheel generators. (USBR)
W69-09765

8D. Soil Mechanics

BELLFIELD DAM, VICTORIA,
Victoria State Rivers and Water Supply Commission (Australia).
D. T. Currey, V. Michels, and D. J. Little.
Inst Eng, Aust. Civ Eng Trans, Vol CE 10, No 1, p 73-93, Apr 1968. 21 p, 17 fig, 1 tab, 18 ref, 2 append, disc.

Descriptors: *Earth dams, Embankments, Rockd dams, Cutoffs, Foreign construction, Grout cu tains, Dam foundations, Engineering geology, Ro excavation, Spillways, Outlet works, *Foundati investigations, Zoned embankments, Stability an ysis, Construction, Earth handling equipment, Tu neling, Instrumentation, Bibliographies.
Identifiers: *Construction methods, Constructi practices, Australia, *Bellfield Dam, Victo (Australia).

The 180-ft Bellfield Dam, located 156 mile we northwest of Melbourne, Australia, has a cent earth core flanked by transition zones and su ported by rockfill shoulders. The foundation vestigation included diamond and percussi drilling, shafts, trenches, and seismic surveys. T foundation was sealed by a cutoff trench and grout curtain. A volumetric balance between spi way excavation and embankment rockfill w maintained during design. A modified Swedish sli circle method, applying May's graphical techniqu was used for embankment stability analyses. T design and construction of the spillway and outl works are described. A mixture of day-labor e ployees using Commission-owned equipment a contract methods was used during constructio Some 70 separate contracts and equipment-hi agreements were used, accounting for 50% of t total prime cost expenditure. Day-labor employe were used for high-labor-content activities. Clo integration of specialist contracting groups with t Commission's experienced day-labor forces w primarily responsible for successful completion the dam in a reasonable time and for a reasonab cost. (USBR)
W69-09521

REPLACEMENT OF WATER BY AIR IN SO PORES,
National Research Council of Canada, Otta (Ontario).
For primary bibliographic entry see Field 02G.
W69-09525

MODEL STUDIES OF AN ARMOURE ROCKFILL OVERFLOW DAM,
International Engineering Co., Inc. San Francisc Calif.
For primary bibliographic entry see Field 08B.
W69-09531

EARTH PRESSURES ON OTTAWA-OUTFA SEWER TUNNEL,
National Research Council of Canada, Otta (Ontario).
For primary bibliographic entry see Field 08A.
W69-09536

THE PROBLEM IN PREDICTING THE SUIT BILITY OF SOILS FOR CEMENTITIOUS ST BILIZATION,
Kent State Univ., Ohio.
J. B. Croft.
Eng Geol Int J, Vol 2, No 6, p 397-424, Nov 196 28 p, 17 fig, 2 tab, 27 ref.

Descriptors: Soils, *Soil stabilization, Soil typ Soil cement, Soil chemical properties, *Soil cl sifications, *Soil physical properties, Soil grou Soil texture, Compressivestrength, Mineralo Soil tests, Clay minerals, Clays, Bibliographies, S mechanics.
Identifiers: Mineral content.

The suitability of a soil for stabilization, the m appropriate stabilizing agent, and the quantity agent are determined by the chemical a mineralogical compositions and texture of a so Soil classification (based upon physical prop ties), compositional indices, and genetic relati ships are examined to determine their value predicting successful stabilization. Suitability o soil depends upon criteria used to define success stabilization. Specifications often require

inimum unconfined compressive strength when here is little relation between this strength and the erformance of the stabilized soil. Smaller quanti-es of stabilizing agent are required for modifying hysical properties than for achieving the specified trength. Chemical and physical properties do not haracterize soils uniquely with regard to their esponse to cementitious stabilizing agents. Group-g soils in an area according to their origins is a ractical solution. (USBR)
V69-09540

E. Rock Mechanics and Geology

RANSIENT PRESSURE TESTING OF FRAC-TURED WATER INJECTION WELLS,
an American Petroleum Corp., Tulsa, Okla.
or primary bibliographic entry see Field 02F.
V69-09499

RANSIENT STRESSES AND DISPLACEMENT ROUND A WELLBORE DUE TO FLUID LOW IN TRANSVERSELY ISOTROPIC, OROUS MEDIA: 1. INFINITE RESERVOIRS,
exas Univ., Austin.
or primary bibliographic entry see Field 02F.
V69-09503

TRESSES AROUND WELLBORES IN NON-INEAR ROCK,
alifornia Univ., Berkeley.
I. A. Mahtab, and R. E. Goodman.
rans Soc Petrol Eng, Amer Inst Mining, Met, and etrol Eng, Inc, Vol 243, Part 2, p 304-312, 1968. p, 21 fig, 4 tab, 6 ref.

escriptors: *Boreholes, *Stress, *Stress analysis, ocks, *Rock mechanics, Strain, Load distribu-on, Elasticity (Mechanical), Elastic deformation, andstones, Wells, Compressive strength, Bounda-ies (Property), Poisson ratio.
dentifiers: Borehole stresses in nonlinear rocks.

he state of stress around a vertical borehole in ock following nonlinear stress-strain laws is ex-mined by means of a finite element analysis. The ffects of nonlinearity of stresses are recorded for 000-ft boreholes in schistose gneiss and Berea andstone using results of laboratory triaxial com-ression tests. The effect is restricted to one well adius from the bottom periphery of the hole. eyond a distance of one-quarter radius, the effect f nonlinearity on stresses is almost always less than % for the phases under investigation. The con-ideration of a static pressure inside the well does ot change the effect of nonlinearity on borehole tresses. (Gabriel-USGS)
V69-09505

UANTIFICATION IN CLAY MINERAL STU-IES OF SEDIMENTS AND SEDIMENTARY OCKS,
mithsonian Institution, Washington, D.C.,; and eorge Washington Univ., Washington, D.C.
W. Pierce, and F. R. Siegel.
Sediment Petrology, Vol 39, No 1, p 187-193, ar 1969. 7 p, 2 fig, 2 tab, 15 ref.

escriptors: *Clay minerals, *Clays, Montmoril-nite, Illite, Geology, Kaolinite, Statistical analy-is, Quantitative analysis, *X-ray analysis, Calcula-ons, Samples, Preparation, Treatment, Diffrac-on, Methodology, Mineralogy, Minerals, Geolog-: investigations, Bibliographies, *X-ray diffrac-on.
dentifiers: Diffractometers.

ercentages of clay minerals present in 25 complex amples were calculated by 5 different methods sing the same X-ray diffractograms. Significantly ifferent results were obtained by the various ethods. Diffuiculties in clay mineral studies exist ecause of inherent factors in the clay minerals and variations in sample treatment and preparation methods. No preference is given to any one calculation technique because each is as well founded as any other. Preparation methods do not appear sufficiently well developed to produce accurate results. Standard samples containing well-crystallized minerals may cause preferential enrichment of certain minerals not generally found in natural mixtures. A unified methodology should be adopted so that semiquantitative clay mineral analyses may be used for comparisons. Until methodological standardization is achieved, reported analyses should include peak area measurements so that comparisons can be made after suitable recalculations. Without standardized sample treatment, preparation, and calculation methods, regional studies will remain incomparable and objectivity in the quantitative approach to geology may be hindered.
W69-09764

8F. Concrete

EXPERIENCE IN DESIGNING THE PRECAST REINFORCED CONCRETE BUILDING FOR THE SARATOV HYDROELECTRIC POWER-PLANT,
A. K. Vakhrameev, V. N. Rudakov, and L. V. Baikova.
Gidrotekh Stroit, No 4, p 10-14, 1966. Transl from Russ, Bur Reclam Transl 704, June 1969. 21 p, 9 fig, 1 tab.

Descriptors: Foreign projects, *Precast concrete, Reinforced concrete, *Concrete technology, Hydraulic structures, Concrete structures, Costs, Hoisting machinery, Manufacturing, Erection, Joints, Foreign design practices, Cost comparisons, Draft tubes, Continuous structures, Joint fillers, Formwork (Construction), Welding, Reinforcement.
Identifiers: USSR, Saratov powerplant, USSR, Construction methods, Reinforcement cages.

The design and construction experience gained by Soviet builders at Saratov Hydroelectric Powerplant is summarized. The large-size precast reinforced-concrete elements used in erecting the underwater parts of the unique structure are feasible and competitive in cost. The main problem in constructing continuous, well-bonded joints to make the structure monolithic, watertight, and equal in strength to monolithic concrete has been solved. Large curvilinear parts can be manufactured satisfactorily in large-size elements on a conveyor line. Metal reinforcement cages for constructing elements without permanent forms had to meet the requirements of manufacturing, 3-dimensional rigidity, symmetrical placement of electrogrids for internal electroheating without too close proximity to reinforcement rods, and free clearance for lowering groups of 12 vibrators between rods and grids to compact the concrete mix. Several changes were made for keeping pier and floorbeam elements in place so that the concrete mix could be placed in the joint area and compacted by vibrators. Care in manufacturing the components resulted in easier and more economical erection. (USBR)
W69-09516

HOT-THERMOS METHOD OF CONCRETING,
Ia Besser.
Stroit, No 10, p 11-12, 1968. Transl from Russ, Bur Reclam Transl 533, Mar 1969. 6 p, 2 fig, 1 ref.

Descriptors: *Concrete technology, *Cold weather construction, Methodology, Concrete placing, Curing, *Heat treatment, Freezing, Heaters, Foreign construction, Calcium chloride, *Concrete construction, Concrete additives, Concrete mixes, Construction.
Identifiers: USSR, *Thermos method, Cold climates, Electroheating, Concrete properties.

The distinguishing part of the hot-thermos method of concreting is that the concrete mix, prepared from cold ingredients, is delivered to the concreting site and heated just before placement. Electroheating is accomplished in a 0.9-cu m tilting bin. Heating the mix to 70 deg C requires 10 to 15 min at 380 v and 120 to 150 kw. A 121-v source can be used when 1 to 1.5% sodium chloride is added, lowering the unit electrical resistance of the mix by about 2 to 3 times, and requiring 25 to 50 kw of power to heat the mix to 50 deg C in 20 min. A cycle including connecting and disconnecting electrical leads requires approximately 45 min. Using staggered operation of 2 bins and a 1.6-cu m dump truck, about 15 cu m of concrete can be produced per shift. If a grade of portland cement that produces concrete with a minimum compressive strength of 400 kg/sq cm is used, the mix attains 50% of design strength by the time it has cooled to zero deg C. The hot-thermos method reduced the cost per cu m of monolithic concrete by 3.5 to 5.5 rubles ($3.88-$6.10) over the cost of electroheating by the rod-electrode method. (USBR)
W69-09517

THERMAL TREATMENT OF HUGE PRECAST COMPONENTS FOR SARATOV HYDROELECTRIC POWERPLANT STRUCTURES,
N. V. Iudina.
Gidrotekh Stroit No 4, p 14-21, 1966. Transl from Russ, Bur Reclam Transl 705, Apr 1969. 28 p, 8 fig, 1 tab, 5 ref, 1 photo.

Descriptors: *Precast concrete, Reinforced concrete, *Concrete technology, Concrete structures, Strain, Foreign design practices, Freeze-thaw tests, Thermal stress, Concrete testing, *Electrodes, Heat flow, *Heat treatment, Cracking, *Cooling, Elasticity modulus, Creep, Quality control, Cold weather construction.
Identifiers: USSR, Foreign testing, Sratov powerplant, USSR, Precast concrete forms, *Electroheating, Temperature rise, Concrete properties.

Prior to inaugurating the assembly-line method of constructing huge precast reinforced-concrete components for Saratov Powerplant structures, field and theoretical investigations were made to determine the best method of heat-curing the 60- to 80-cu m components rapidly enough to permit unmolding at 10 to 12% design strength and erection at 60% without reducing quality or slowing flow of finished products to the erection site. Full-size specimens were tested by uniform periphery heating to 50 and 80 deg C and electrode-grid internal heating to 80 deg C. Internal electroheating, using the conductivity of the mix to raise the temperature of the specimen at the required rate, prevented surface cracking. Timing and temperatures of electroheating, cooling and moisture-curing cycles must be rigidly controlled to allow the concrete to attain full strength and frost resistance. Properties of the concrete in the specimens, variously treated and cured, were determined by testing cores drilled at different ages. Procedures for manufacturing massive components in summer and winter, the method of installing the electrode grids, and the tests leading to the recommendations are described. (USBR)
W69-09518

PRESTRESSED CONCRETE PILES,
Pomeroy (J. H.) and Co., Inc., San Francisco, Calif.; and Gerwick (Ben C.) Co., San Francisco, Calif.
Ben C. Gerwick, Jr.
J Prestressed Concr Inst, Vol 13, No 5, pp 66-93, Oct 1968. 28 p, 8 fig, 44 ref.

Descriptors: *Prestressed concrete, Pile bearing capacities, *Concrete piles, Bibliographies, Pile driving, *Pile foundations, Bending moments, Pile friction, Pile lateral loads, *Piles (Foundations), Friction piles, Sheet piling, Durability, Bearing piles, Cracking, Design, Ultimate loads, Foundations.
Identifiers: Splicing, Ultimate strength, Lightweight concretes, Pile caps, Pretensioning.

Prestressed concrete piles are employed extensively in marine structures and foundations. Advantages are strength in bearing and bending, durability, and economy. This report is a discussion of a state-of-the-art presentation on prestressed piling as used throughout the world. The field is discussed under the following headings: utilization, design, manufacture, installation, economy, sheet piling, fender piles, splices, problems and failures, durability, and research and development. The annual consumption of prestressed concrete piling is approximately 187 million ft. Prestressed concrete piles have been constructed in the cylindrical form up to 13.1 ft in diameter (Oosterschelde Bridge, Netherlands) and up to 230 ft long (offshore platforms in the Gulf of Maracaibo, Venezuela). In some parts of the U S, there is a trend toward using single long lengths without splices. Piles 131 ft long have been installed for major buildings in San Francisco and Boston. In other areas of the U. S. and other countries, the trend is toward the manufacture of standardized segments, spliced during driving. (USBR)
W69-09542

8G. Materials

FRICTION WEAR AND LUBRICATION,
Cambridge Univ. (England).
Michael J. Furey.
Ind Eng Chem, Vol 61, No 3, p 12-29, Mar 1969. 18 p, 12 fig, 2 tab, 67 ref.

Descriptors: *Friction, *Lubrication, Additives, Technology, Theory, Viscosity, Temperature, Pressure, Bibliographies, Foreign research, Physics, Roughness, Lubricants, Heat, Oil, Greases, Maintenance, Operation and maintenance, Power operation and maintenance.
Identifiers: Friction coefficient (Mech), *Wear, Great Britain, Roughness projections.

The study of friction, wear, and lubrication is approached as an important part of the broader subject of the solid-solid interface. Some special problems in studying solid-solid contact under static and dynamic conditions, and the theoretical and experimental approaches used are discussed. Not enough is known about the detailed conditions existing between rubbing solid surfaces, such as frequency of contact, surface temperatures, pressures, and shear rates. Examples of direct and indirect attempts to measure these conditions include a variety of studies in a high-contact stress, sliding system--a fixed ball on a rotating cylinder. Contact devices and radiotracer techniques have provided additional information on the function of antiwear and antifriction additives in boundary lubrication. Measurements of surface temperatures, using the dynamic thermocouple method, are described. Emphasis has been placed on the more fundamental aspects of solid-solid contact and on recent work in the field of boundary lubrication, the area in which physics and chemistry play important parts. (USBR)
W69-09520

8I. Fisheries Engineering

FISH AND GAME CONSERVATION.
For primary bibliographic entry see Field 06E.
W69-09641

FISH AND GAME CONSERVATION.
For primary bibliographic entry see Field 06E.
W69-09642

IMPORTING FISH.
For primary bibliographic entry see Field 06E.
W69-09643

CONTROL OF TEMPERATURES OF WATER DISCHARGED FROM A MULTIPLE-PURPOSE RESERVOIR,
Corps of Engineers, Vicksburg, Miss.
For primary bibliographic entry see Field 04A.
W69-09706

OPERATIONAL PROBLEMS ASSOCIATED WITH A BASIN RESERVOIR SYSTEM,
Corps of Engineers, Omaha, Nebr. Missouri River Div.
For primary bibliographic entry see Field 04A.
W69-09707

GAME AND FISH COMMISSION.
For primary bibliographic entry see Field 06E.
W69-09775

FISHING AND HUNTING LICENSES.
For primary bibliographic entry see Field 06E.
W69-09776

FISHING REGULATIONS.
For primary bibliographic entry see Field 06E.
W69-09785

MISCELLANEOUS PROVISIONS RELATING TO HUNTING AND FISHING.
For primary bibliographic entry see Field 06E.
W69-09786

MUSSELS.
For primary bibliographic entry see Field 06E.
W69-09787

COASTAL FISHERIES LAWS (FISH AND GAME).
For primary bibliographic entry see Field 06E.
W69-09814

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For primary bibliographic entry see Field 06E.
W69-09815

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For primary bibliographic entry see Field 06E.
W69-09841

COMMERCIAL FISHING.
For primary bibliographic entry see Field 06E.
W69-09842

10. SCIENTIFIC AND TECHNICAL INFORMATION

THE IDENTIFICATION AND CRITICAL ANALYSIS OF SELECTED LITERATURE DEALING WITH THE RECREATIONAL ASPECTS OF WATER RESOURCES USE, PLANNING, AND DEVELOPMENT,
Illinois Univ., Urbana. Water Resources Center.
Robert B. Ditton.
Research Report No 23, Water Resources Center, University of Illinois, June 1969. 293 p, 3 tab, 809 ref. OWRR Project A-025-ILL.

Descriptors: *Recreation, Recreation dema
Water quality, Attitudes, Behavior, *Planni
Hydrology, Legal aspects, Water quality contr
Water pollution effects, Research and devel
ment, Reviews, Bibliographies, Documentati
*Information retrieval.

This study integrates and summarizes the high
fragmented, interdisciplinary body of knowled
dealing with recreation and water. Over
thousand publications were identified, do
mented, and classified according to keywo
descriptors. A topical computerized bibliograp
retrieval routine was developed. Using this retrie
system, the project surveyed and critically analyz
research findings and their implications for wa
recreation planning and development. The nar
tive critical analysis of pertinent literature is
ganized within five broad areas: (1) the wa
resource, (2) water resource recreation planni
(3) user-resource planning considerations, (4) fa
tors inhibiting the recreational use of wa
resources, and (5) maintaining water quality
recreational use. In citing gaps in existing metho
and knowledge, this critical analysis forms
bibliographic foundation for a programatic identi
cation of interdisciplinary recreation-wa
resources research needs. These research needs
grouped according to: (1) the water resource,
user-resource planning, (3) water quality ma
tenance for recreational use. An extensive biblio
raphy is included. (Betchart-Univ of Ill)
W69-09719

**A PLAN FOR A COMPREHENSIVE WATE
RESOURCES RESEARCH INFORMATIO
EXCHANGE SYSTEM,**
Leeds, Hill and Jewett, Inc., San Francisco, Calif.
Harvey O. Banks, and Charles G. Wolfe.
Available from the Clearinghouse as PB-185 8
for $3.00 in paper copy, $0.65 in microfiche. Fi
Report to OWRR, Jul 1969. 137 p.

Descriptors: *Documentation, *Reviev
*Planning, Publication, Information retrieval.
Identifiers: State Water Resources Research
stitutes, Information exchange, Technical societi

A study was made of the nature and effectiven
of the present procedures used by the Office
Water Resources Research of the United Sta
Department of the Interior and the 51 State Wa
Resources Research Institutes to obtain inform
tion on problems requiring research and to d
seminate the results of research projects. A surv
conducted among heads of water development a
water quality control agencies in every state, o
cials of water departments or utilities in ma
American cities, and selected consulting engine
ing firms throughout the country specializing
water matters revealed that the research inform
tion exchange systems of OWRR and the State
stitutes have not been effective. Only 49% of the
potential users were able to name a water resear
project sponsored by OWRR in their home sta
only 21% were able to name an OWRR sponsor
project in some other state, and only 14% were ab
to name an OWRR research project, the result
which they had used in their work. More than ha
53%, of the potential users felt that there we
problems which required study, which were n
being investigated. The report contains a reco
mended research information exchange system
overcome the demonstrated deficiencies of the e
isting systems. In the recommended system, the
formation gathering and dissemination activities
OWRR and the State Institutes would be bet
defined and would be expanded, and use would
made of the capabilities of Federal information d
semination services, Professional Societies, a
other communication media.
W69-09737

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Georgia Water Resources Center	W69-09727 -- 09730 09740	5
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SELECTED WATER RESOURCES ABSTRACTS

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Deoartment of the Interior

VOLUME 2, NUMBER 24
DECEMBER 15, 1969

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As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

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FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.

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- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the FWPCA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

In cooperation with the Federal Water Pollution Control Administration, the following "centers of competence" have been established:

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
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SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1A. Properties

VISCOUS DISSIPATION IN EXTERNAL NATURAL CONVECTION FLOWS,
Cornell Univ., Ithaca, N.Y.
B. Gebhart, and J. Mollendorf.
J Fluid Mech, Vol 38, Part 1, p 97-127, Aug 14, 1969. 11 p, 4 fig, 1 tab, 4 ref, 2 append. NSF Grant GK 1963.

Descriptors: *Convection, *Viscous flow, *Fluid mechanics, Heat transfer, Mass transfer, Flow, Turbulence, Laminar flow, Turbulent flow, Viscosity, Diffusion.
Identifiers: Prandtl number.

The effects of viscous dissipation are considered for external natural convection flow over a surface. A class of similar boundary-layer solutions is given and numerical results are presented for a wide range of the dissipation and Prandtl numbers. Several general aspects of similarity conditions for flow over surfaces and in convection plumes are discussed and their special characteristics considered. The general equations including the dissipation effect are given for the non-similar power law surface condition. (Knapp-USGS)
W69-10091

1B. Aqueous Solutions and Suspensions

EVALUATION OF IRREVERSIBLE REACTIONS IN GEOCHEMICAL PROCESSES INVOLVING MINERALS AND AQUEOUS SOLUTIONS--2. APPLICATIONS,
Northwestern Univ., Evanston, Ill. Dept. of Geology.
Harold C. Helgeson, Robert M. Garrels, and Fred T. Mackenzie.
Geochim et Cosmochim Acta, Vol 33, No 4, p 455-481, Apr 1969. 27 p, 11 fig, 70 ref. Work supported by Nat Sci Found, Amer Chem Society, and Northwestern Univ.

Descriptors: *Mineralogy, *Mineral water, *Aqueous solutions, *Chemical reactions, *Geochemistry, Water temperature, Pressure, Forecasting, Mass transfer, Geology, Weathering, Evaporation, Diagenesis, Hydrolysis.
Identifiers: Mineral-forming reactions.

Equilibrium relations among common rock-forming minerals and aqueous solutions over a range of temperatures and pressures are known experimentally for a number of systems and can be calculated for others. This information permits prediction of the mass transfer involved in chemical reactions characteristic of geochemical processes. Calculations of this kind are used to examine various chemical and geologic implications of irreversibility in idealized models of weathering, evaporative concentration, diagenesis, hydrothermal rock alteration and ore deposition. (Gabriel-USGS)
W69-10092

SILICA IN AQUEOUS SOLUTIONS,
Akademiya Nauk SSSR, Moscow. Institut Geokhimii i Analiticheskoi Khimii.
B. N. Ryzhenko, and N. I. Khitarov.
Transl from Geokhimiya, USSR, No 8, p 957-961, 1968. Published by Geochemical Society. Geochem Int, Vol 5, No 4, p 791-795, 1968. 5 p, 3 fig, 7 ref.

Descriptors: *Aqueous solutions, *Silica, *Silicates, Water temperature, Acidic water, Alkaline water, Crystallization, Ions, Anion exchange, Metals, Electrical properties, Sodium, Potassium, Conductivity, Hydrolysis.
Identifiers: Silicate anions.

A study was made of the conductances of vapor-saturated aqueous solutions of silica and metal oxides (K, Na, and Li) at temperatures from 50 to 250 deg C. Definite structures were established for silicate anions, but an increase in Me/Si in dilute solutions causes an increase in the charge per Si atom. The same increase is observed in concentrated solutions, and is interpreted as transformation of uncharged molecular silica to ionic silica. (Gabriel-USGS)
W69-10122

DISSOLVED ORGANIC MACROMOLECULES IN SEA WATER,
Akademiya Nauk URSR. Inst. of Biology of the Southern Seas.
For primary bibliographic entry see Field 02K.
W69-10125

02. WATER CYCLE

2A. General

PROPERTIES OF NON-HOMOGENEOUS HYDROLOGIC SERIES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
V. Yevjevich, and R. I. Jeng.
Colo State Univ Hydrol Pap No 32, Apr 1969. 33 p, 28 fig, 5 tab, 6 ref.

Descriptors: *Statistical methods, *Time series analysis, *Markov processes, *Stochastic processes, *Probability, Synthetic hydrology, Model studies, Mathematical models, Statistics.
Identifiers: Non-homogeneous hydrologic series, Consistency analysis, Homogeneity of data.

The effects of inconsistency (systematic errors) and non-homogeneity of data (man-made or natural changes in the environment) on hydrologic variables and time series are investigated. Independent sequences and first order Markov linear dependent sequences are used. Known trends are superposed on the stationary series. Changes in the probability density functions, including mean, variance, skewness, excess, and serial correlation are analytically determined for various cases of jumps and trends assumed in advance as the known non-homogeneity and/or inconsistency. Inconsistency and non-homogeneity introduce dependence into the independent series, and increase the dependence of the first order Markov linear models. Usually the first serial correlation coefficient is increased. Some forms of inconsistency and non-homogeneity may transform the one-peak probability density functions into two-peak or multi-peak density functions. Consequently, the statistical parameters of a series with inconsistent and non-homogeneous data become significantly different from those of the original series. As hydrologic time series are often subject to inconsistency and non-homogeneity, a portion of the positive dependence and the higher variance in such a series comes from these two factors. (Knapp-USGS)
W69-09902

TOTAL RUNOFF TRAVEL TIME DURING THE FORMATION OF MIXED 'SURFACE-SUBSURFACE' RAIN FLOODS IN SMALL WATER COURSES,
State Hydrological Inst., Leningrad (USSR).
I. B. Vol'ftsun.
Transl from Trudy GGI, No 152, 1968, p 66-71. Soviet Hydrol, Selec Pap No 3, p 222-226, 1968. 5 p, 3 fig, append.

Descriptors: *Rainfall-runoff relationships, *Subsurface runoff, *Runoff forecasting, *Hydrographs, Duration curves, Floods, Flood forecasting, Infiltration, Recharge, Groundwater movement, Discharge (Water).
Identifiers: Travel time (Runoff), USSR, Valdai Hydrologic Laboratory.

Total travel time of runoff in a catchment consists of surface and subsurface runoff and channel travel time. Hydrographs for local runoff forecasting were constructed using data from experimental catchments in the Valdai Hydrologic Scientific Research Laboratory, USSR. For the watersheds measured, total travel time is directly proportional to the amount of precipitation and inversely proportional to daily average air temperature. Runoff data for the 2 experimental watersheds were collected between 1952 and 1962 and are tabulated. (Knapp-USGS)
W69-09915

THE APPLICATION OF CROSS-SPECTRAL ANALYSIS TO HYDROLOGIC TIME SERIES,
Colorado State Univ., Fort Collins, Dept. of Civil Engineering.
For primary bibliographic entry see Field 06A.
W69-09938

WATERSHED MANAGEMENT: EFFECTS ON BASIN DEVELOPMENT,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
George N. Newhall, and James L. Smith.
Proc Amer Soc Civil Eng, Billings Conf, Irriga and Drainage Div, Oct 7 1965. p 47-86.

Descriptors: *Watershed management, *River basins, Water yield, Sedimentation, Hydrology, Water delivery, Snowpacks, Erosion control, California.
Identifiers: River basin development.

Watershed basin management has a significant influence upon total water yield, timing of water delivery, and upon sedimentation. Storage and loss determination for watersheds, treatments for erosion control and snowpack management are discussed. (Smith-Forest Ser)
W69-09999

HYDROLOGY OF FOREST LANDS AND RANGELANDS,
Forest Service (USDA), Washington, D.C.; and Agricultural Research Service, Washington, D.C.
Herbert C. Storey, Robert L. Hobba, and J. Marvin Rosa.
In Handbook of Applied Hydrology, p 22-1 to 22-52, illus, 1964. McGraw-Hill, New York.

Descriptors: *Watershed management, *Hydrologic aspects, *Hydrograph analysis, *Vegetation effects, Rainfall-runoff relationships, Peak discharge, Flood control, Erosion, Sedimentation, Watersheds (Basins), Runoff coefficient, Overland flow, Snowmelt.
Identifiers: *Fire effects, Infiltration procedure, Snowmelt analysis.

This section of the handbook was prepared for land managers, engineers, hydrologists, and others who need information on how forest and range vegetation affects the hydrologic functions of watersheds. Emphasis is placed upon explanation of the hydrologic processes undergone by water in places where forest and range vegetation can affect it. A list of definitions of terms is included.
W69-10002

REPORT NO. 4: FOREST AND WATER RESEARCH PROJECT, DELAWARE-LEHIGH EXPERIMENTAL FOREST,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station; and Pennsylvania Dept. of Forests and Waters, Harrisburg.
Irvin C. Reigner, W. E. McQuilkin, and E. F. McNamara.
Pennsylvania Department Forests and Waters, Harrisburg, Pa., 1961. 97 p, illus.

Descriptors: *Watershed management, *Hydrologic cycle, *Forest management, *Vegetation effects,

*Evapotranspiration, Oak trees, Pine trees, Streamflow, Water yield, Interception, Soil moisture, Groundwater, Calibrations, Watersheds (Basins), Herbicides.
Identifiers: *Experimental watersheds, Scrub oak, Pitch pine, Soil moisture measurement, Groundwater measurement, Hydrologic analysis, Watershed calibration, Planting and seeding, Fire effects.

This is the fourth progress report on results of the scrub oak conversion studies and calibration of the Dilldown watershed. A single-watershed calibration is being developed, based on prediction of monthly and annual runoff from climatic variables. Daily streamflow, ground-water elevation, soil moisture, and climatic data are tabulated for 4 water years, October 1954 through September 1958. (Reigner-Forest Ser)
W69-10005

FOREST HYDROLOGY RESEARCH IN THE UNITED STATES,
Forest Service (USDA), Washington, D.C.
For primary bibliographic entry see Field 09C.
W69-10006

TECHNIQUES IN GRASSLAND WATERSHED RESEARCH,
Forest Service (USDA), Washington, D.C. Div of Watershed, Recreation, and Range Research.
E. G. Dunford.
IN Proc XIV Congress Int Union Forestry Res Org., Munich, 1967. p 444-462.

Descriptors: *Watershed management, *Grasslands, *Vegetation effects, *Evapotranspiration, Overland flow, Lysimeters, Rainfall-runoff relationships, Infiltration, Precipitation (Atmospheric), Interception, Runoff, Soil erosion, Soil moisture, Sedimentation.
Identifiers: *Experimental watersheds, Sediment movement.

Research on grassland watersheds has not received as much attention as that on forest and cultivated lands, but more is needed. Many of the techniques used on other vegetation types are applicable to grasslands, but some adaptation is needed to obtain data on precipitation, interception, infiltration, and soil movement. These adaptive techniques are discussed. (Reigner-Forest Ser)
W69-10007

GEOLOGIC CONTROL OF RAINFALL-RUNOFF RELATIONS IN THE PEAK CREEK WATERSHED, PULASKI AND WYTHE COUNTIES, VIRGINIA,
Virginia Polytechnic Inst., Blacksburg. Dept. of Geological Science.
Byron N. Cooper.
Virginia Polytech Inst Water Resources Res Center Rep, May 1969. 24 p, 7 plate, 4 tab, 21 ref. OWRR Proj No A-004-VA.

Descriptors: *Rainfall-runoff relationships, *Appalachian Mountain region, *Virginia, *Geologic control, Infiltration, Groundwater movement, Surface-groundwater relationships, Hydrologic data, Gaging stations, Geology, Drainage patterns (Geologic), Geochemistry, Geomorphology, Hydrogeology.
Identifiers: *Geologic control of runoff.

Investigation of the rainfall-runoff coefficient for the Peak Creek watershed above Gatewood Dam in Pulaski and Wythe counties, Virginia, was undertaken by rain and runoff gaging of 4 easily recognized hydrogeologic terranes-each of which is composed of a part of the stratigraphic succession that possesses distinctive hydrologic characteristics. Studies of sample plots of individual hydrogeologic terranes, areas embracing 2 different terranes, 3 different terranes, and of the entire drainage area which embraces all 4 terranes provides overwhelming evidence that rainfall-runoff coefficients for sandstone-shale terranes are higher by 40 to 80% than for other hydrogeologic terranes. In smaller watersheds in which hydrogeologic terranes with unusually high runoff factors predominate, gross underestimations of water impoundment possibilities in western Virginia are likely if the rule-of-thumb runoff coefficient of 0.30 to 0.33 is used. Geologic maps can serve very usefully as a base for deriving estimated probable rainfall-runoff coefficients for terranes similar to the 4 described in the study of the Peak Creek watershed. Runoff from Appalachian limestone-dolomite terranes is almost 1/3 that of shale-sandstone hydrogeologic terranes in the same watershed. (Knapp-USGS)
W69-10090

INSTANTANEOUS UNIT HYDROGRAPH RESPONSE BY HARMONIC ANALYSIS,
Virginia Polytechnic Inst., Blacksburg. Dept. of Civil Engineering.
Jonathan T. Phillippe, and James M. Wiggert.
Virginia Polytech Inst Water Resources Res Center Rep, Mar 1969. 30 p, 9 fig, 2 tab, 14 ref, 2 append. OWRR Proj No A-014-VA.

Descriptors: *Rainfall-runoff relationships, *Hydrograph analysis, *Unit hydrographs, *Statistical methods, *Computer programs, Streamflow forecasting, Fourier analysis, Synthetic hydrology, Analytical techniques, Runoff forecasting.
Identifiers: Harmonic analysis, IUH.

Prediction of streamflow is a primary need in hydrological application, The time span of the prediction can range from several hours or days for flood and outlet work studies to months or years for water-supply determination. Research was proposed to test the efficacy of the IUH method for short-term analysis and prediction. The method uses harmonic analysis to describe the Instantaneous Unit Hydrograph. The Instantaneous Unit Hydrograph is the curve that results when the discharge past a given point in the stream is plotted versus time, as a unit quantity of rainfall excess is released instantaneously over the watershed. Harmonic analysis expresses the form of the hydrograph function in a finite series. Some further definition work is necessary because the study results indicate inadequacies in the present details of the method. The results of the prediction calculations are highly dependent on the number of data presented in the computation. The watersheds do not always exhibit consistency in the predictor forms. Despite the problems, the method offers promise in operational streamflow predication. The method is particularly adaptable to the digital computer, and it lends itself to continuous, real-time hydrograph computation if given data from remote sensing devices such as rain gages, weirs and groundwater monitors. A computer program and some results of computations are included. (Knapp-USGS)
W69-10098

GROUND WATER SHARE OF THE WATER BALANCE AND AN EXAMPLE OF A RIVER CATCHMENT IN THE SEASIDE REGION (POLISH),
Bernard Wrobel.
Polski Akad Nauk Rozpr Hydrotech, Part 23, p 227-237, 1969. 11 p, 4 fig, 5 tab.

Descriptors: *Water balance, *Groundwater, *River flow, Hydrologic properties, River basins, Geology, Geomorphology, Mountains, Altitude, Watersheds (Basins), Precipitation (Atmospheric), Water loss, Infiltration, Surface flow.
Identifiers: *Poland, Water balance (Groundwater share).

The share of groundwaters in the water balance was investigated by using the hydrogeological data of the Reda and Zagorksa Struga Rivers of Poland. The study shows the presence of geological old valleys dividing the basins of these 2 rivers into 2 geomorphologically different structures. By mer ing these 2 river basins into a single river basin o the basis of their geological similarity and their a pearance as a single stream in their lower reache the analysis of the hydrologic data shows that th mean annual precipitation of this combine catchment area of 640 sq km is 644.5 mm wi 11.8% utilized for ground retention, 23.4% for su face runoff, and 64.8% considered as the wat loss. (Gabriel-USGS)
W69-10104

DEVELOPED EQUATION OF THE WATE BALANCE (POLISH),
Kazimierz Debski.
Polski Akad Nauk Rozpr Hydrotech, Part 23, p 4 50, 1969. 6 p, 2 tab, 5 ref.

Descriptors: *Water balance, *River basin *Mathematical studies, Runoff, Surface runof Soils, Zoning, Water loss, Precipitation (A mospheric), Water circulation, Water supply, Infi tration, Evapotranspiration, Evaporation, Vegeta tion.
Identifiers: River basin water balance.

This article develops a more sophisticated wat balance equation applicable to a river basin on th basis of analyzing the water balance equation a consisting of two parts, i.e. the surface and ground water zones. A phenomenon of infiltration is co sidered to be the only hydrologic property whic serves as a connecting link between these tw zones. The use of this sophisticated water balanc leads to reliable interpretations of water circul tions in continental areas and, especially, to th evaluation of groundwater recharge as a result precipitation infiltration. The same equation pe mits the quantitative determination of th transevaporation process. (Gabriel-USGS)
W69-10108

POTENTIALLY BIGGEST RUNOFF FRO TORRENTIAL RAINFALLS (POLISH),
Kazimierz Debski.
Polski Akad Nauk, Rozpr Hydrotech, Part 23, 51-64, 1969. 14 p, 4 fig, 4 tab, 9 ref.

Descriptors: *Rainfall, *Runoff, *Streamflow Watersheds (Basins), Topography, Forecastin Altitude, High water mark, Low water mark, Stor runoff, Synoptic analysis, Mathematical studies.
Identifiers: *Poland, Torrential rainfall runoff.

Stream runoff, as a result of torrential rainfalls, wa analyzed on the basis of the data recorded by Polis hydrological gaging stations. The maximum runof as a result of a torrential rain, is very different fro a runoff formed by spreading rains. These 2 type of rain runoff cannot be expressed by a single fo mula common to these 2 phenomena. The pea rate of storm runoff increases with the growth water basin and can be well represented by definite monotonic function, whereas the peak ru noff from a spreading rain increases with an in crease in the water basin area, according to definite parabolic function. The study also show that under the same physiographic conditions th peak rate of a storm runoff in small basins is greate than that from spreading rains. In evaluating the ru noffs from their corresponding rainfalls the Pagla formula was adapted as the most suitable for th hydrogeological conditions prevailing in the Polis areas. (Gabriel-USGS)
W69-10112

THE PROBLEM OF THORNTHWAITE AN MATHER'S METHOD OF WATER BALANC IN ITS APPLICATION TO POLAND (POLISH),
Polish Academy of Sciences, Warsaw. Inst. Geography.
Krzysztof Wojciechowski.
Pol Akad Nauk, Int Geogr Prace Geogr No 6 1968. 80 p, 31 fig, 11 tab, 81 ref.

Descriptors: *Water balance, *Hydrologic cycle, Mathematical studies, Climates, Climatic data, Water loss, Water supply, Recharge, Low water mark, High water mark, Gaging stations, Mountains, Altitude, Storage capacity, Precipitation (Atmospheric), Evapotranspiration, Dynamics.
Identifiers: Thornthwaite and Mather's water, Water balance method.

The application of Thornthwaite and Mather's method for the study of water balance of Polish territory was investigated using data from 159 hydrologic stations located at altitudes below 500 m. The mountain regions of the territory have been left out of consideration in the belief that for them the water balance pattern would fail to illustrate fully their differentiation in hydrologic features. The calculations were based on recorded climatic data, using normal mean values, and assuming the water storage capacity of the soil to be 200 mm. The water balance evaluated by using the Thornthwaite and Mather method, gives a good understanding of the interrelation of the water supply and water needs, and the effect of soil retention on this interrelation. Several areas exist where both water-defficiency and water-surplus types predominate. (Gabriel-USGS)
W69-10127

INFLUENCE OF VARIOUS FACTORS ON THE DEPTH OF SOIL FREEZING IN THE CATCHMENTS OF THE NORTHWESTERN EUROPEAN USSR,
State Hydrological Inst., Leningrad (USSR).
A. A. Kapotov.
Transl from Trudy GGI, No 152, 1968, p 79-92. Soviet Hydrol, Selec Pap No 3, p 227-237, 1968. 11 p, 5 fig, 7 tab, 10 ref.

Descriptors: *Frost, *Freezing, *Soils, *Frozen ground, *Forecasting, Planning, Runoff forecasting, On-site investigations, On-site data collections, Rainfall-runoff relationships.
Identifiers: *USSR, Valdai Hydrologic Laboratory, Frost depth forecasting.

Methods were developed at the Valdai Hydrologic Scientific Research Laboratory, USSR, to predict seasonal soil freezing depth, which must be taken into account in predicting spring runoff, water balance calculations, and in many engineering projects. Freezing characteristics are also necessary in estimating growth and planting time of crops. Data were collected at Valdai, Pskov, Novgorod, and Moscow between 1951 and 1967. Freezing depth was determined by permafrost meter and by trenching. In the areas studied, the depth of freezing depends largely on the type of vegetation. In fields the depth is greater by a factor of 1.5 to 2 than in the forests, averaging 33 cm in fields and 15 cm in forests. In severe winters, field soils freeze about 20-25 cm deeper than forest soils, and in mild winters, 5-15 cm deeper. Deepest freezing is in plowed fields where it averaged 42 cm. Minimum depths are in waterlogged forested ravines, which average 14 cm. Sandy soils freeze deeper than loamy soils. The main weather factors affecting freezing are air temperature and snow depth. Under deep snow, soils often remain unfrozen all winter. Freezing depth relations are summarized both by emprical equations and graphically. Comparisons with field data show that the relations are reasonably accurate for forecasting. Probability curves were plotted for several areas and were found to predict freezing depths fairly well. (Knapp-USGS)
W69-10132

SHORT-RANGE FORECASTING OF OVERLAND-RIVER RUNOFF,
Gidrometeorologicheskii Institut, Leningrad (USSR).
Yu. M. Alekin.
Available from the Clearinghouse as OTS Transl No 61-11468, $3.00 in paper copy, 0.65 in microfiche. Transl from Gidrometeorologicheskoe Izdatel'stvo, Liningrad, 1956. 229 p, 100 fig, 24 tab, 191 ref.

Descriptors: *Streamflow forecasting, *Runoff forecasting, Water balance, Rainfall-runoff relationships, Statistical methods, Hydrograph analysis, Gaging stations.
Identifiers: *USSR, Isochrone method, Tendency method, Textbook.

The main methods of short-range riverflow forecasting used in the USSR are described in a textbook for a course, Hydrological Forecasting of River Runoff, for university hydrometeorology students. The tendency, corresponding-stage, isochrone, and water-balance methods are described as well as statistical methods for evaluating short-range forecasts. (Knapp-USGS)
W69-10146

METEROLOGICAL AND HYDROLOGICAL DROUGHT IN RARITAN RIVER BASIN IN NEW JERSEY,
Rutgers - The State Univ., New Brunswick, N. J. Water Resources Research Inst.
Chin S. Liu, and W. B. Snow.
Available from ASME, 345 East 47th St., New York, 10017, for $1.50 per copy. Order as 69-PID-3. ASME/AIChE Water Pollution Conference, Rutgers University, New Brunswick, New Jersey, June 1969. 6 p, 3 tab, 6 fig. OWRR Project A-002-N.J.

Descriptors: *Droughts, Water balance, Hydrologic data, Sequential generation.

The 1961-66 drought in the Northern part of New Jersey was the most intense ever recorded in the region. The meteorological droughts, indicated by the Palmer Drought Index, and the corresponding hydrological droughts were investigated. The drought sequence is a time series characterized by a Markov chain process. Long sequences of generated drought data were utilized for evaluating the various drought distributions. (Liu-NY)
W69-10184

2B. Precipitation

RECORDED OBSERVATIONS ON THE INFLUENCE OF CLOUDINESS AND WIND VELOCITY ON THE BRIGHTNESS OF THE DAYLIGHT SKY ABOVE THE WATER SPACE (RUSSIAN),
A. N. Rayevskiy.
Izv Akad Nauk, SSSR, Fiz Atmos i Okeana, Vol 5, No 5, p 539-542, May 1969. 4 p, 1 fig, 4 tab, 2 ref.

Descriptors: *Cloud cover, *Wind velocity, *Light intensity, *Surveys, Photometers, Instrumentation, Light quality, Wavelengths, Altitude, Fog, Temperature, Water temperature, Atlantic Ocean, Aerosols.
Identifiers: Daylight brightness (Atlantic Ocean).

The effect of cloudiness and wind velocity on the brightness of the sky over broad water surfaces was investigated by recording the observations during the R/V 'Sedov' expedition in the Atlantic and Arctic Oceans. The observations were made by using an integral photoelectric photometer of effective wavelengths of 0.550, 0.660 and 0.890 mkm. The brightness intensity increases with the increase of wind velocity for all wavelength values and the presence of water dust in the atmosphere begins to be significant for a wind velocity of about 15-16 m/sec. (Gabriel-USGS)
W69-09899

2C. Snow, Ice, and Frost

GLACIAL ACCUMULATIONS, DRAINAGE AND ICE RECESSION IN THE NARVIKSKJOMEN DISTRICT, NORWAY,
Uppsala Univ. (Sweden). Dept. of Physical Geography.
Ragnar Dahl.
Norsk Geograf Tidskr, Vol 22, p 101-165, 1968. 165 p, 47 fig, 2 tab, 55 ref.

Descriptors: *Glacial drift, *Glaciers, *Regimen, *Ablation, *Drainage, Sediments, Glacial soils, Ice, Altitude, Lakes, Watersheds (Basins), Climates, Topography, Fjords, Carbon, Radioactivity, Shores, Deltas, Mapping, Geology, Erosion, Dating.
Identifiers: *Norway, Narvik-Skjomen District.

Glacial accumulations and other phenomena of the Narvik-Skjomen District of Norway are discussed on the basis of geological data and the use of earlier publications. The study shows that most of the late-glacial accumulations at low levels in these districts are ice-front deltas or delta moraines. Thus these accumulations cannot be correlated with the drainage of any large ice-dammed lakes east of the watershed, as has earlier been maintained. Repeated beds of moraines on stratified sediments indicate that there were small climatic fluctuations, but the different accumulations are not synchronous. The ages of the investigated ice-front accumulations have been calculated on the basis of shorelines and some C-14 dating, showing that the heads of the fjord valleys were deglaciated at low levels as early as 7900-7500 B. C. (Gabriel-USGS)
W69-09924

MOISTURE MOVEMENT TO A FREEZING FRONT,
Army Terrestrial Sciences Center, Hanover, N.H.
For primary bibliographic entry see Field 02G.
W69-09928

INSTRUMENTATION FOR SNOW GAGING -- YESTERDAY, TODAY, AND TOMORROW,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 07B.
W69-09992

SNOW EVAPORATION REDUCTION: MIGRATION OF EVAPORATION SUPPRESSANTS THROUGH SNOW,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 07B.
W69-09993

GAMMA-TRANSMISSION PROFILING RADIOSOTOPE SNOW DENSITY AND DEPTH GAGE,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 07B.
W69-09994

ISOTOPE SNOW GAGES FOR DETERMINING HYDROLOGIC CHARACTERISTICS OF SNOWPACKS,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 07B.
W69-09995

ISOTOPES -- A MULTIPURPOSE TOOL FOR FOREST WATERSHED RESEARCH,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 07B.
W69-09996

PORTABLE RADIOACTIVE ISOTOPE SNOW GAGES FOR PROFILING SNOWPACKS,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 07B.
W69-09997

TRANSPORT OF INTERCEPTED SNOW FROM TREES DURING SNOW STORMS,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
David H. Miller.

US Forest Service Res Paper PSW-33, Pacific Southwest Forest and Range Experiment Station, Berkeley, California, 1966. 30 p.

Descriptors: *Snow, Melt water, Hydrology, Watershed management, Winds, Solar radiation, California, *Interception, Stemflow.
Identifiers: Vapor flux, Intercepted snow.

Five principal processes by which intercepted snow in trees is removed during snow storms are described: vapor flux from melt water, vapor flux from bodies of snow, stem flow and drippings of melt water, sliding of bodies of intercepted snow from branches, and wind erosion and transport of intercepted snow. (Smith-Forest Service)
W69-09998

A GAMMA-TRANSMISSION GAGE FOR PROFILING SNOWPACK,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 07B.
W69-10000

MEASUREMENT OF SNOWPACK PROFILES WITH RADIOACTIVE ISOTOPES,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 07B.
W69-10001

PERMAFROST AND RELATED ENGINEERING PROBLEMS IN ALASKA,
Geological Survey, Washington, D.C.
Oscar J. Ferrians, Jr., Reuben Kachadoorian, and Gordon W. Greene.
Geol Surv Prof Pap 678, 1969. 37 p, 36 fig, 4 tab, 28 ref.

Descriptors: *Permafrost, *Engineering geology, *Soil water, *Alaska, Foundations, Soil mechanics, Arctic, Frozen ground, Cold regions, Ice, Tundra, Subsidence.
Identifiers: Permafrost engineering, Thermokarst, Polygonal ground, Ice wedges, Pingos.

Permafrost, or perennially frozen ground, is a widespread natural phenomenon. It underlies approximately 20% of the land area of the world. The permafrost region of Alaska, which includes 85% of the State, is characterized by a variety of permafrost-related geomorphic features including patterned ground, pingos, thaw lakes, beaded drainage, thaw or thermokarst pits, and muck deposits. Known permafrost thickness ranges from about 1,300 ft near Barrow in northern Alaska to less than a foot at the southern margin of the permafrost region. The distribution of permafrost is controlled by climatic, geologic, hydrologic, topographic, and botanic factors. The extensive permafrost region of Alaska poses special engineering problems for the design, construction, and maintenance of all types of structures. Lack of knowledge about permafrost has resulted in tremendous maintenance costs and even in relocation or abandonment of highways, railroads, and other structures. Because of the unique geologic-environmental conditions that exist in permafrost areas, special engineering procedures should be used, not only to minimize disruption of the natural environment, but also to provide the most economical and sound methods for developing the natural resources of the permafrost region of Alaska. (Knapp-USGS)
W69-10106

INFLUENCE OF VARIOUS FACTORS ON THE DEPTH OF SOIL FREEZING IN THE CATCHMENTS OF THE NORTHWESTERN EUROPEAN USSR,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02A.
W69-10132

VELOCITY OF COMPRESSIONAL WAVES IN POROUS MEDIA AT PERMAFROST TEMPERATURES,
Chevron Research Co., La Habra, Calif.
A. Timur.
Geophysics, Vol 33, No 4, p 584-595, Aug 1968. 12 p, 6 fig, 2 tab, 17 ref.

Descriptors: *Seismic properties, *Permafrost, *Seismic studies, *Elasticity (Mechanical), Porous media, Sound waves, Seismology, Frozen ground, Frozen soils, Cold regions, Surveys, Ice, Freezing, Soil mechanics, Porosity, Sandstones, Shales.
Identifiers: *Compressional wave velocity (Permafrost), Elastic wave propagation.

Measurements of velocity of compressional waves in consolidated porous media, conducted within a temperature range of 26 deg C to -36 deg C, indicate that: (1) compressional wave velocity in water-saturated rocks increases with decreasing temperature whereas it is nearly independent of temperature in dry rocks; (2) the shapes of the velocity versus temperature curves are functions of lithology, pore structure, and the nature of the interstitial fluids. As a saturated rock sample is cooled below 0 deg C, the liquid in pore spaces with smaller surface-to-volume ratios (larger pores) begins to freeze and the liquid salinity controls the freezing process. As the temperature is decreased further, a point is reached where the surface-to-volume ratio in the remaining pore spaces is large enough to affect the freezing process, which is completed at the cryohydric temperature of the salt-water system. In the ice-liquid-rock matrix system, present during freezing, a 3 phase, time-average equation may be used to estimate the compressional wave velocities. Below the cryohydric temperature, elastic wave propagation takes place in a solid-solid system consisting of ice and rock matrix. In this frozen state, the compressional wave velocity remains constant, has its maximum value, and may be estimated through use of the two-phase time average equation. Limited field data for compressional wave velocities in permafrost indicate that pore spaces in permafrost contain not only liquid and ice, but also gas. Therefore, before attempting to make velocity estimates through the time-average equations, the natures and percentages of pore saturants should be investigated. (Knapp-USGS)
W69-10138

INVESTIGATION OF A METHOD OF MEASURING SNOW STORAGE BY USING THE GAMMA RADIATION OF THE EARTH,
State Hydrological Inst., Leningrad (USSR).
N. V. Zotimov.
Transl from Trudy GGI, No 152, 1968, p 114-130. Soviet Hydrol Selec Pap No 3, p 254-265, 1968. 12 p, 10 tab, 6 fig, 6 ref.

Descriptors: *Snow surveys, *Water equivalent, *Instrumentation, *Nuclear meters, Snow cover, Snow packs, Water yield, Snow, Runoff, Nuclear moisture meters, Radioactivity, Moisture content.
Identifiers: Gamma-ray snow meters, Soil radioactivity.

Analysis of the method of measuring the water equivalent of snow using the natural radioactivity of the earth and the results of field tests showed that the use of the radioelectronic snow gage for this purpose under stable snow cover conditions is fully justified. Under these conditions, the errors in the measurement of snow storage with the M-100 instrument do not exceed 2.58 mm for a snow storage between 10 and 300 mm. The errors in the measurement of the water equivalent of snow increase for an unstable snow cover because of considerable variations in the moisture content of soil in the layer from 0 to 20 cm. The efficiency of snow measurements is 5-6 times higher than that by the weighing method, and determination of the water equivalent of snow is much less laborious, particularly in the presence of a frozen snow crust or ice crust. (Knapp-USGS)
W69-10142

2D. Evaporation and Transpiration

INTRA-ANNUAL DISTRIBUTION OF EVAPORATION FROM LAND IN THE USSR,
State Hydrological Inst., Leningrad (USSR).
P. P. Kuz'min, L. I. Zubenok, A. R. Konstantinov, N. I. Astakhova, and V. V. Vinogradov.
Transl from Trudy GGI, No 151, 1968, p 5-11 Soviet Hydrol, Selec Pap No 3, p 201-206, 1968. 6 p, 1 fig, 2 tab, 4 ref.

Descriptors: *Evaporation, *Evapotranspiration Humidity, Water balance, Statistical methods, Climatology, Energy budget, Meteorology, Soil moisture, Plants, Vegetation effects.
Identifiers: *USSR.

Evapotranspiration was computed for 186 stations in the USSR by the water balance method and for 156 stations by a method using air temperature and humidity. The discrepancies between results of the 2 methods can be considerable. The results of the calculations are summarized and tabulated by months, geographic regions, and types of vegetation, (Knapp-USGS)
W69-09920

DETERMINATION OF THE SEASONAL AND MONTHLY EVAPORATION NORMALS FROM AGRICULTURAL FIELDS FROM OBSERVATIONS AT A NETWORK OF STATIONS,
State Hydrological Inst., Leningrad (USSR).
P. P. Kuz'min, S. F. Fedorov, and B. A. Pomytkin.
Trans from Trudy GGI, No 151, 1968 p 12-29 Soviet Hydrol, Selec Pap No 3, p 206-221, 1968. 16 p, 3 fig, 19 ref, 5 append.

Descriptors: *Evaporation, *Evapotranspiration Humidity, Climatology, Energy budget, Meteorology, Soil moisture, Plants, Crops, Vegetation effects.
Identifiers: *USSR.

A method if given for determining long-period average seasonal and monthly evaporation from agricultural fields during the warm period, May-September. The method uses an empirical graphic relationship between crop evaporation coefficient and the radiational aridity index. Calculations of evaporations are tabulated and compared with evaporimeter measurements in all the major geographic regions of the USSR. (Knapp-USGS)
W69-09921

EFFECT OF DYE ON SOLAR EVAPORATION OF BRINE,
New Mexico State Univ., University Park. Dept. of Civil Engineering.
C. G. Keyes, Jr., and N. N. Gunaji.
OSW Contract No 14-01-001-511. Invest supported by contract with Office of Saline Water. Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Publ No 78, p 338-347, 1968. 10 p, 2 fig, 3 tab, 18 ref.

Descriptors: *Evaporation, *Waste disposal *Brines, Hydrologic budget, Heat budget, Energy budget, Water temperature, Color, Solar radiation Heated water, Absorption.
Identifiers: Dyes, Heat absorbing dyes.

Studies were made of the effect of dyes on solar evaporation of brine at the Roswell Saline Water Conversion Plant Effluent Ponds, near Roswell, New Mexico. This program, initiated in the spring of 1965, observed the effect of Methylene Blue, Congo Red, Nigrosine, Bismark Brown, and 2-Naphthol Green dyes on solar evaporation of brine. To evaluate the efficiencies of increases evaporation and the economic feasibility of the addition of dyes, evaporation must be determined accurately. The energy budget and water budget methods for evaluating the effect of dye on the solar evaporation of brine in Modified Cummings Radiation Integrators are discussed. The addition of Methylene Blue dye affected the short-wave reflectivity, Bowen's Ratio, and the evaporated depth. The ad-

tion of Congo Red dye affected the surface tem-erature and the Bowen's Ratio of the brine. The udy shows that the Water Budget Method for etermining evaporated depth in a Modified Cum-ings Radiation Integrator is more reliable than ie Energy-budget Method. The calculations of vaporated depth by this method support the ypothesis that the Methylene Blue dye will in-rease the solar evaporation of brine while the ongo Red dye has little or no effect on the vaporation of brine. (Knapp-USGS)
/69-09923

OMPUTER TECHNOLOGY IN EVAPORA-ION STUDIES,
ew Mexico State Univ., University Park. Dept. of ivil Engineering; and New Mexico State Univ., niversity Park. Engineering Experiment Station.
. G. Keyes, Jr., and N. N. Gunaji.
ymp on Use of Analog and Digital Computers in ydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci ydrol, Publ No 81, p 650-660, 1968. 11 p, 3 fig, 8 ref.

escriptors: *Evaporation, *Data processing, Digital computers, Mass transfer, Energy budget, ydrologic budget, Statistical methods, Surveys, ata collections, Data storage and retrieval.
lentifiers: Evaporation data reduction.

he energy budget, mass transfer, and water udget methods were used to evaluate evaporation ippression techniques and the effects of dyes on ie solar evaporation of brines. Most of the 9 terms the energy budget equation were recorded on 2-channel potentiometric multipoint recorders. lean values of each of the terms, which could in-ude one or more variables, were obtained over a iermal survey period of at least 7 days. These ean values were arrived at by first dividing each iermal survey period into subperiod time with an msler Integrator, and then using the digital com-uter to obtain the mean values of each term for ach thermal survey period. A computerized robable error analysis was run on the results and n each term of all the methods in conjunction with ach method. This statistical analysis showed that ie Water Budget Method was the most reliable of ie 3 methods used. Although the normal Mass ransfer Method of determining evaporation is latively simple, most mass transfer coefficients do ot produce adequate results for an area. There-ore, new quasi empirical Mass Transfer formulas ere developed by using a least squares program fit the periodical data. The new Mass Transfer coef-cients apply to 2 areas which are approximately 00 mi apart. (Knapp-USGS)
/69-09930

VAPORATION INVESTIGATIONS AT LEPHANT BUTTE RESERVOIR IN NEW IEXICO,
ew Mexico State Univ., University Park. En-ineering Experiment Station.
arendra N. Gunaji.
ymp on Geochem, Precipitation, Evaporation, oil-Moisture, Hydrom, Proc Gen Assembly of ern (Sept-Oct 1967), Int Ass Sci Hydrol, Publ No 8, p 308-325. 18 p, 1 fig, 4 tab, 9 ref.

escriptors: *Evaporation, *Reservoir evapora-on, *New Mexico, Rio Grande, Climatology, nergy budget, Mass transfer, Evaporation control, leteorology, Arid lands.
lentifiers: *Elephant Butte Reservoir (N Mex).

'ater losses by evaporation were studied at lephant Butte Reservoir, near Truth or Con-quences, New Mexico. Evaporation suppression vestigations require the determination of vaporation as accurately as possible to evaluate ie efficiencies of evaporation savings and the conomic feasibility of suppression. The deter-ination of evaporation at this Rio Grande site is nportant not only for suppression studies to fol-w, but also for the growing problems involving in-rstate and international water rights and the relia-bilities and assurances of domestic water delivery. Water losses by evaporation from Elephant Butte Reservoir were determined utilizing the energy-budget technique. The Cummings Radiation Integrator (CRI) was tested as an effective means for measuring net incoming radiation. The coefficient N in the quasi-empirical mass-transfer equation of evaporation was determined using the energy-budget method as a control. The coefficient K in the heat-transfer equation of energy convected to or from the reservoirs surface was evaluated. The significance of errors in data analysis in evaporation studies was determined. (Knapp-USGS)
W69-09934

MODIFICATIONS AND EVALUATING OF THE EVAPOTRANSPIRATION TENT,
Forest Service (USDA) Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
Arnett C. Mace, Jr., and J. R. Thompson.
USDA Forest Serv Res Paper RM-50, 1969. 16 p.

Descriptors: *Evapotranspiration, *Measuring instruments, *Evaluation.
Identifiers: *ET tent.

Evidence indicates that reduced ventilation rate is the principal cause of heat buildup inside the original plastic evapotranspiration tent. After the tent was modified to increase wind movement, data indicated no significant increase in air temperature within the enclosure as long as it was fully occupied by vegetation. Future modification should include a variable tent size and improved air-flow measurements. (Thompson-Forest Service)
W69-09984

DEVELOPED EQUATION OF THE WATER BALANCE (POLISH),
For primary bibliographic entry see Field 02A.
W69-10108

ANNUAL REPORT OF PHREATOPHYTE ACTIVITIES, 1967,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 03B.
W69-10126

COMPARATIVE ESTIMATE OF METHODS OF COMPUTING EVAPORATION FROM BODIES OF WATER,
State Hydrological Inst., Leningrad (USSR).
V. I. Kuznetsov, and T. G. Fedorova.
Transl from Trudy GGI, No 152, 1968, p 94-113. Soviet Hydrol Selec Pap No 3, p 239-253, 1968. 15 p, 14 tab, 5 fig, 8 ref, 2 append.

Descriptors: *Evaporation, *Reservoir evaporation, *Evaluation, Humidity, Winds, Evaporation pans, Lakes, Energy budget, Water balance, Temperature, Vapor pressure, Forecasting.
Identifiers: *USSR.

Methods of forecasting evaporation from bodies of water developed and used in the USSR are compared and evaluated. Computed evaporation values were compared with observations using floating evaporation pans. Results are tabulated and summarized. The most accurate method was based on use of vapor pressure and wind velocity data, using formulas by Zaykov, Braslavskiy and Vikulina. (Knapp-USGS)
W69-10131

WATER TRANSFER FROM SOIL TO THE ATMOSPHERE AS RELATED TO SOIL PROPERTIES, PLANT CHARACTERISTICS AND WEATHER,
Agricultural Research Service, Riverside, Calif. Salinity Lab.
S. L. Rawlins, R. S. Austin, E. M. Cullen, W. N. Herkebrath, and G. J. Hoffman.
US Army Electron Command Atmos Sci Lab Tech Rep ECOM 2-68-F, Dec 1968. 137 p, 41 fig, 6 tab, 51 ref.

Descriptors: *Evapotranspiration, *Instrumentation, Water quality, Water balance, Transpiration, Evaporation, Lysimeters, Soil water movement, Solar radiation, Temperature, Stomata.
Identifiers: Psychrometers.

Independent measurements of matric and osmotic potential show that the osmotic potential of a NaCl solution is significantly lowered by interaction with the soil matrix. This is explained by salt exclusion from the zone near soil particle surfaces. Advances in technology for measurement of water potential include a thermocouple for direct attachment to plant leaves, a device for automatic cycling and recording of outputs from Peltier thermocouple psychrometers, detailed instructions and illustrations for assembly of thermocouple psychrometers and a multiple temperature water bath. A microchamber for studying plant responses to environment is described. In it, light intensity and duration, ambient temperature, relative humidity, and carbon dioxide concentration are controlled, and transpiration, carbon dioxide assimilation, and plant and soil water potential are measured. Data for the ratio of transpiration to carbon dioxide assimilation for cotton are given. Moderate salinity increased this ratio. Preliminary results from experiments to determine how plants integrate time varying salinity indicate that transpiration per unit leaf area is decreased by salinity. Knapp-USGS)
W69-10136

DETERMINATION OF WATER SURFACE TEMPERATURE FROM RADIO EMISSION IN THE CENTIMETER RANGE,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 07B.
W69-10140

2E. Streamflow and Runoff

DISPERSION OF FLOATING PARTICLES IN UNIFORM CHANNEL FLOW,
Technical Univ. of Denmark, Copenhagen.
For primary bibliographic entry see Field 02J.
W69-09887

LONGITUDINAL DISPERSION IN OPEN CHANNELS,
Pittsburgh Univ., Pa.
Attila A. Sooky.
ASCE Proc, J Hydraul Div, Vol 95, No HY 4, Pap 6697, p 1327-1346, July 1969. 20 p, 5 fig, 28 ref, 3 append.

Descriptors: *Dispersion, *Open channel flow, Turbulent flow, Steady flow, Mixing, Diffusion, Streamflow, Water pollution treatment.
Identifiers: Longitudinal dispersion.

The effects of cross-sectional geometry and velocity distribution on the dispersion process in straight, uniform open channels with large width-to-depth ratio are investigated. The method of investigation follows Taylor's approach and thus the results apply after the elapse of an initial period during which a constant dispersion coefficient has developed. Under the assumed conditions the longitudinal dispersion coefficient can be described by a general expression in which the hydraulic radius and the shear velocity are variables. Dispersion varies significantly with cross-sectional shape, width-to-hydraulic radius ratio, and the Reynolds number. The calculated values and pattern of variation are compared to available data for open channels with irregular cross section. (Knapp-USGS)
W69-09888

RESISTANCE TO REVERSING FLOWS OVER MOVABLE BEDS,
Technical Univ. of Istanbul (Turkey).
M. Bayazit.
ASCE Proc, J Hydraul Div, Vol 95, No HY 4, Pap 6649, p 1109-1127, July 1969. 19 p, 17 fig, 12 ref, 2 append.

Descriptors: *Bed load, *Alluvial channels, *Tides, *Currents (Water), Waves (Water), Channel morphology, Ripple marks, Regime, Roughness (Hydraulic), Model studies, Hydraulic models, Sedimentation, Sediment transport.
Identifiers: Reversing flow.

Configuration of a movable bed changes periodically as the velocity of the reversing flow over it varies in time. Experiments are carried out with bed materials of various densities. Ripples generated on the bed surface are essentially similar to those of unidirectional flow, but their shapes are reversed as to conform with the flow direction. The resistance of such a bed depends on grain Froude number and grain Reynolds number. The importance of viscosity in determining the resistance is emphasized. The resistance function at the instant of peak velocity is determined for the conditions of movable-bed tidal models. Ripple friction factor is found not to depend on the depth and the period of the flow in the ranges used in the experiments. Relationships determining the resistance of a movable bed for tidal model conditions are presented. (Knapp-USGS)
W69-09892

FRICTION-FACTORS FOR FLAT-BED FLOWS IN SAND CHANNELS,
Iowa Univ., Iowa City.
F. Lovera, and John F. Kennedy.
ASCE Proc, J Hydraul Div, Vol 95, No HY 4, Pap 6678, p 1227-1234, July 1969. 8 p, 2 fig, 1 tab, 20 ref, 2 append.

Descriptors: *Open channel flow, *Turbulent flow, *Alluvial channels, Hydraulics, Roughness (Hydraulic), Roughness coefficient, Sediment transport, Bed load, Regime, Model studies, Hydraulic models.
Identifiers: Friction factor (Hydraulic).

A method is developed for determining friction factors of open channel flows over flat sand beds in an active state of transport. The graphical predictor is derived from both field and laboratory data, and is presented in a format similar to that of the Moody pipe-friction diagram. The variation of friction factor with Reynolds number for constant values of the ratio of hydraulic radius to median sediment size was found to be much different for these flows than for one-phase flows in rigid-boundary conduits. (Knapp-USGS)
W69-09893

BASIC DATA REPORT NO 3 FOR RESEARCH ON FLOOD FREQUENCY FOR SMALL DRAINAGE AREAS,
Geological Survey, Jackson, Miss.
James W. Hudson.
Geol Surv Open-file Rep, June 1969. 102 p, 2 fig, 3 ref, append.

Descriptors: *Floods, *Small watersheds, *Mississippi, *Data collections, *Hydrologic data, Peak discharges, Stage-discharge relations, Gaging stations.
Identifiers: Mississippi flood data.

Small drainage basin flood frequency data for Mississippi are summarized and tabulated. Peak stages and discharges recorded through March 1968 are included. Each record includes station number, location, gage history, basin parameters, type of flow, and a table of stages and discharges. (Knapp-USGS)
W69-09895

FLOODPLAIN INFORMATION, FIVE MILE CREEK, METROPOLITAN BIRMINGHAM, ALABAMA.
Corps of Engineers, Mobile, Ala.
For primary bibliographic entry see Field 04A.
W69-09896

FLOODPLAIN INFORMATION, SWEETWATER, JACKSON, CAMP, BEAVER RUN, AND BROMOLOW CREEKS, METROPOLITAN ATLANTA, GEORGIA.
Corps of Engineers, Savannah, Ga.
For primary bibliographic entry see Field 04A.
W69-09897

FLOODPLAIN INFORMATION, FOURCHE CREEK AND TRIBUTARIES, LITTLE ROCK, ARKANSAS - PART 1.
Corps of Engineers, Little Rock, Ark.
For primary bibliographic entry see Field 04A.
W69-09898

DISCHARGE MEASUREMENT IN OPEN CHANNELS BY DILUTION METHODS (FRENCH),
Liege Univ. (Belgium).
For primary bibliographic entry see Field 07B.
W69-09905

TOTAL RUNOFF TRAVEL TIME DURING THE FORMATION OF MIXED 'SURFACE-SUBSURFACE' RAIN FLOODS IN SMALL WATER COURSES,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02A.
W69-09915

NUMERICAL SIMULATION OF WAVE-CREST MOVEMENT IN RIVERS AND ESTUARIES,
Geological Survey, Washington, D.C.
Chintu Lai.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 699-713, 1968. 15 p, 6 fig, 2 tab, 9 ref.

Descriptors: *Model studies, *Computer models, *Digital computers, *Synthetic hydrology, Estuaries, Rivers, Waves (Water), Floods, Routing, Tides, Streamflow, Numerical analysis, Open channel flow, Unsteady flow.
Identifiers: Method of characteristics, Implicit method.

The set of partial differential equations describing unsteady flow in an open channel can be solved numerically by using appropriate mathematical methods for digital computers, such as the method of characteristics or the implicit method. Computer programs have been written for the application of such mathematical methods to a large number of water elements so that the wave-crest movement in the waterway can be numerically simulated. By taking a sufficiently large number of water elements and sufficiently small time intervals, it is possible to obtain a series of realistic, illustrative, and continuous pictures with appropriate computer peripheral equipment. Such pictorial or graphical outputs from the digital computer may be in the form of line-printer outputs, X-Y plotter drawings, cathode-ray tube displays, or movie-film exposition. Two examples from surface water hydrology problems, one for the flood wave movement in a river, the other for the tidal wave movement in an estuary, indicate that this technique of so-called 'numerical experiment' affords a means to accurately and economically investigate flood or tidal flow at the prototype scale and provides many advantages over other methods. (Knapp-USGS)
W69-09919

FLOW MEASURING STRUCTURES IN THE HYDROLOGICAL OBSERVATION NETWORK,
Research Inst. for Water Resources Development, Budapest (Hungary).
O. Starosolszky.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967),, Int Ass Sci Hydrol, Publ No 78, p 384-394, 1968. 11 p, 8 fig, 3 ref.

Descriptors: *Stream gages, *Equipment, Flumes, Weirs, Instrumentation, Depth, Discharge (Water), Flow rates, Hydrographs, Gaging stations, Stage discharge relations, Streamflow, Networks.
Identifiers: *Hungary.

In order to stabilize the relationship between stage and discharges in small watercourses and canals special gaging structures are necessary for continuous discharge recording. During the last 10 yr some 60 different gaging structures have been designed and constructed in Hungary. The mean error of discharge measurement can be calculated on the basis of the mean error of function values. To limit error in discharge measurement, the minimum heads at gages must be specified. In order to eliminate the effect of channel changes, special gaging structures were developed. The relative mean error of flow volume can be found by interpreting duration curves. Methods are suggested for estimating the error in flow volume due to the neglect of submergence. In order to avoid errors favorable flow conditions must be secured by design of measuring structures, the major dimensions must be adjusted to an accuracy of a few mm and submergence should be allowed but rarely. The hydrologist utilizing these data should be well-informed on the reliability of his measurement. (Knapp-USGS)
W69-09929

HYDROLOGIC DISTRIBUTIONS RESULTING FROM MIXED POPULATIONS AND THEIR COMPUTER SIMULATION,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 07C.
W69-09935

RIVERS AND LAKES OF THE MONGOLIAN PEOPLE'S REPUBLIC (RUSSIAN),
Gidrometeorologicheskii Institut, Leningrad (USSR).
V. L. Shul'ts.
Trudy Nauch-Issled Gidrometeorol Inst, Leningrad, USSR, Issue No 37 (52), 1967. 22 p, 6 fig, 3 tab, 8 ref.

Descriptors: *Rivers, *Lakes, *Physical properties, Pressure, Permafrost, Hydrologic aspects, Glaciers, Climates, Precipitation (Atmospheric), Air temperature, Rain, Water sources, Snowmelt, Aquifers, Runoff, Water resources, Hydrographs, Salinity.
Identifiers: *USSR, Mongolian People's Republic, Outer Mongolia.

A monograph discusses in a very general manner the rivers and lakes of the Mongolian People's Republic on the basis of earlier publications and author's recent hydrogeological research. The book contains the following chapters: (1) natural conditions; (2) Mongolian mountains; (3) climate; (4) rivers; (5) water sources; (6) annual runoff variations; (7) annual runoff distribution, (8) total annual resources; (9) description of the principal rivers; and (10) lakes. (Gabriel-USGS)
W69-09941

STREAMFLOW RECORDS FROM THE SAN DIMAS EXPERIMENTAL FOREST, 1939-1959,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
J. S. Krammes, J. D. Lent, and J. W. Clarke.
US Forest Serv Res Note PSW-79, Pacific SW Forest and Range Exp Sta, Berkeley, Calif, 1965. 10 p, illus.

Descriptors: *Hydrographs, *Hydrologic data, *Chaparral, Hydrology, Streams, Data collections, Demonstration watersheds, California, Watersheds (Basins), Discharge (Water).
Identifiers: Southern California, Experimental watersheds.

Summarizes hydrographs covering 314 station-years of record. Mean daily streamflow tables

flood peak tables, and supplemental watershed data are on microfilm, which is available upon request. (Krammes-Forest Service)
W69-09990

SELECTED URBAN STORM WATER RUNOFF ABSTRACTS.
Franklin Inst. Research Labs., Philadelphia, Pa. Science Information Services.
For primary bibliographic entry see Field 04C.
W69-10085

FLOOD PLAIN INFORMATION, MISSISSIPPI RIVER AT NATCHEZ, MISSISSIPPI.
Corps of Engineers, Vicksburg, Miss.
For primary bibliographic entry see Field 04A.
W69-10086

FLOODS OF JANUARY AND FEBRUARY 1969 IN CENTRAL AND SOUTHERN CALIFORNIA,
Geological Survey, Menlo Park, Calif.
A. O. Waananen.
Geol Surv Open-file Rep, May 20, 1969. 233 p, 28 fig, 1 photo, 7 tab.

Descriptors: *Floods, *California, *Data collections, *Hydrologic data, Streamflow, Stage-discharge relations, Water levels, Surface waters, Hydrographs, Rainfall, Disasters, Discharge (Water).
Identifiers: Central and Southern California floods.

Floods of unprecendented magnitude in late January and late February 1969 created havoc in the Santa Clara River and Santa Ynez River basins, California, and record-breaking floods occurred in many other basins. The floods resulted from a series of storms in January and February, notably the heavy rains of Jan 18-22, 24-27, and Feb 22-25. Rain was particularly heavy in the San Bernardino, San Gabriel, Santa Monica, and Santa Ynez Mountains, and in southern Sierra Nevada. Maximum precipitation of 33 in. was observed Jan 24-27 at Mount Baldy Notch in the San Gabriel Mountains; the total precipitation for January and February at this station was nearly 85 in. The peak discharge of 165,000 cfs Jan 25 in Santa Clara River at Saticoy and 100,000 cfs in Santa Ynez River near Lompoc far exceeded the previous maximum flows of record. The suspended-sediment concentration and discharge observed in several streams greatly exceeded any previously observed. The maximum concentration observed was 75,000 mg/l in Santa Clara River at Saticoy, but peak concentration was estimated to be as high as 160,000 mg/l. An estimated load of more than 150,000 tons of dissolved solids was discharged to the sea Jan 18-31 by the Santa Clara River. Groundwater levels showed substantial rises following the floods as a result of percolation of storm runoff and floodflows, notably in alluvial-fan areas such as the foothills of the San Gabriel Mountains. (Knapp-USGS)
W69-10089

GEOLOGIC CONTROL OF RAINFALL-RUNOFF RELATIONS IN THE PEAK CREEK WATERSHED, PULASKI AND WYTHE COUNTIES, VIRGINIA,
Virginia Polytechnic Inst., Blacksburg. Dept. of Geological Science.
For primary bibliographic entry see Field 02A.
W69-10090

VISCOUS DISSIPATION IN EXTERNAL NATURAL CONVECTION FLOWS,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 01A.
W69-10091

SMALL-STREAM FLOOD INVESTIGATIONS IN MINNESOTA (OCT 1958-SEPT 1967),
Geological Survey, Minneapolis, Minn.
Lowell C. Guetzkow, and George H. Carlson.
Geol Surv Open-file Rep, Apr 1969. 174 p, 15 fig, 1 tab.

Descriptors: *Floods, *Data collections, *Small watersheds, *Minnesota, Streamflow, Hydrographs, Gaging stations, Flow characteristics, Stage-discharge relations, Peak discharge.
Identifiers: *Crest-stage stations, Flood peak, Flood measurements.

An investigation of flood flows from small drainage basins in Minnesota was initiated to aid in the design of bridges, culverts and other highway drainage structures. The program provides peak flow data on streams having drainage areas generally less than 50 sq mi, placing particular emphasis on those less than 10 sq mi. Published data, when supplemented by some additional years of flood record, are the basis for a statewide flood frequency study. Basin parameters being investigated for their effect on floods are drainage area, length of main stream, slope of main stream, stream density, relief ratio, basin shape, and vegetal cover. Each of the 144 gaging stations included in the report are equipped with crest-stage gages, and 10 stations have continuous recorded records of stage and precipitation. Hydrographs of significant flood events are presented for most recording stations. The relative magnitude of flood flows for different hydrologic regions are shown in graphs which relate maximum discharge to drainage area size. Each station record contains location, drainage area, records available, type of gage, on-site structure elevations, bankfull stage, and annual maximum stage and discharge data. (Lang-USGS)
W69-10093

WATER RESOURCES OF THE JOPLIN AREA, MISSOURI,
Geological Survey, Rolla, Mo. Water Resources Div.
For primary bibliographic entry see Field 02F.
W69-10095

IDENTIFICATION OF SPECTRAL CHARACTERISTICS OF HYDROLOGICAL SERIES BY A MODIFICATION OF THE GRENANDER-ROSENBLATT METHOD (RUSSIAN),
I. V. Khomeriki.
Soobsch Akad Nauk, Gruz SSR (Bull Acad Sci of Georgian SSR), Vol 53, No 3, p 661-664, Mar 1969. 4 p, 1 fig, 5 ref. English summary provided with Russian text.

Descriptors: *Runoff forecasting, *Time series analysis, *Hydrologic data, *Mathematical models, Runoff, Water pressure, Energy transfer, Statistical methods, Correlation analysis, Frequency, Discharge (Water), Hydrologic equation, Electronics, Computers.

In calculating regulating systems of river runoff 2 alternative hypothesis are considered: (a) Runoff is a random process with a periodic trend; (b) Runoff is a random process without a periodic trend. At first sight hypothesis (b) would seem to be a special case of (a). However, there is an essential difference between them. Whereas hypothesis (a) accounts for the cyclic variations of runoff by the presence of a periodic component, hypothesis (b) attributes these variations to the stationariness of the process. Spectral analysis of hydrological series enables ascertainment of the parameters of the periodic trend. This is the first attempt to use the modified method of Rossenblatt and Grenander for this purpose in hydrology. (Gabriel-USGS)
W69-10096

SURFACE-WATER DISCHARGE AND GROUND-WATER LEVELS IN THE EAST FORK RIVER AREA, SUBLETTE COUNTY, WYOMING,
Geological Survey, Riverton, Wyo.
D. J. O'Connell.
Geol Surv Data Rep, Mar 1969. 77 p, 3 fig, 6 tab.

Descriptors: *Data collections, *Hydrologic data, *Streamflow, *Water wells, *Water levels, Water level fluctuations, Aquifers, Discharge (Water), Runoff.
Identifiers: Sublette County (Wyo).

Basic data on streamflow, water quality, and water levels in wells in the East Fork River area of Sublette County, Wyoming, July 1965 to July 1968, are compiled. Drillers logs are included to show typical terrace deposit composition. (Knapp-USGS)
W69-10097

INSTANTANEOUS UNIT HYDROGRAPH RESPONSE BY HARMONIC ANALYSIS,
Virginia Polytechnic Inst., Blacksburg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
W69-10098

FLOODS OF JULY 2, 1968, IN JACKSON, MISSISSIPPI,
Geological Survey, Jackson, Miss.
B. E. Wasson.
Geol Surv Open-file Rep, Jan 1969. 10 p, 4 fig.

Descriptors: *Floods, *Mississippi, *Urbanization, Hydrographs, Rainfall, Rainfall-runoff relationships, Data collections, Discharge (Water), Streamflow, Small watersheds, Isohyets, Profiles.
Identifiers: *Jackson (Miss).

An urbanized belt along Woodrow Wilson Avenue in northwestern Jackson, Mississippi, received more than 4 inches of rain during a 5-hr period July 2, 1968. About 3 inches of the rain fell during 1 hr; recurrence interval of this rainfall is in excess of 10 yr. Severe flooding occurred on streams in the central part of the Town Creek basin. West Branch Town Creek at Derrick Street had the highest stage since at least 1953. The 1953 flood was much more severe than the July 2, 1968 flood, except in a small area upstream from the mouth of West Branch Town Creek. Town Creek at Gallatin Street and Lynch Creek at Valley Street had floods representing 3-yr recurrence intervals, and Eubanks Creek at Wood Dale Drive had a 2-yr recurrence interval flood. However, some of the smaller streams in the central part of the Town Creek basin had more severe floods. (Knapp-USGS)
W69-10101

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN THE DISTRICT OF COLUMBIA.
Corps of Engineers, Baltimore, Md. North Atlantic Div.
For primary bibliographic entry see Field 04A.
W69-10102

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN MARYLAND.
Corps of Engineers, Baltimore, Md. North Atlantic Div.
For primary bibliographic entry see Field 04A.
W69-10103

GROUND WATER SHARE OF THE WATER BALANCE AND AN EXAMPLE OF A RIVER CATCHMENT IN THE SEASIDE REGION (POLISH),
For primary bibliographic entry see Field 02A.
W69-10104

HYDROLOGY OF A PART OF THE BIG SIOUX DRAINAGE BASIN, EASTERN SOUTH DAKOTA,
Geological Survey, Washington, D.C.
Michael J. Ellis, Donald G. Adolphson, and Robert E. West.
Geol Surv Hydrol Invest Atlas HA-311, 1969. 5 p, 9 fig, 3 map, 6 tab, 24 ref.

Descriptors: *Water resources, *Hydrogeology, *South Dakota, Surface waters, Groundwater, Water wells, Streamflow, Floods, Water levels, Water level fluctuations, Aquifers, Water quality.
Identifiers: Big Sioux River (S Dak).

The water resources of the Big Sioux drainage basin, eastern South Dakota, are described in a 1-sheet hydrological atlas with an accompanying 5 p text. Bedrock geology, streamflow, and water quality are shown by maps and tabulated data. Hydrographs show water level fluctuations in 33 observation wells and summarize the discharge of the Big Sioux River. Flood frequencies are shown graphically. (Knapp-USGS)
W69-10110

DISCHARGE MEASUREMENTS AT GAGING STATIONS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07B.
W69-10111

GEOCHEMICAL EVOLUTION OF OUED SAOURA (NORTHWESTERN SAHARA) WATERS (FRENCH),
Centre de Recherches sur les Zones Arides, Paris (France).
For primary bibliographic entry see Field 02K.
W69-10114

METHOD OF DETERMINING THE DISCHARGE OF TWO-LEVEL SPILLWAYS,
Sredneaziatskii Nauchno-Issledovatelskii Institut Irrigatsii, Tashkent (USSR).
For primary bibliographic entry see Field 08B.
W69-10129

WATER RECORDS OF PUERTO RICO, 1958-63,
Geological Survey, Washington, D.C.
Frank P. Kipple.
Geol Surv Open-file Rep, 1968. 353 p, 15 fig.

Descriptors: *Data collections, *Surface waters, *Groundwater, *Puerto Rico, Streamflow, Water levels, Water quality, Stream gages, Observation wells, Rivers, Reservoirs, Stage-discharge relations, Water temperature, Sediment discharge, Hydrologic data.
Identifiers: Surface water records, Groundwater records, Water quality records, Water resources data.

The surface-water, quality-of-water, and groundwater records of Puerto Rico for calendar years 1958 through 1963 are presented. Included are records for streamflow stations, water wells, and the chemical and physical characteristics of the streams and groundwater. The location of all stations, except miscellaneous stations, is shown on maps of river basins and areas adjoining these basins. Each map is followed by the tabulation of water records in the particular basin and area shown on the map. The records were collected by the Caribbean District of the Water Resources Division, U.S. Geological Survey, in financial cooperation with several agencies of the Commonwealth of Puerto Rico. (Knapp-USGS)
W69-10134

EXPERIMENTAL PALEOHYDROLOGIC INVESTIGATIONS,
Leningrad State Univ. (USSR). Dept. of Geography.
N. I. Makkaveyev, and A. M. Kalinin.
Transl from Izvestiya Akad Nauk SSSR, Ser Geograf, No 4, 1968, p 15-22. Soviet Hydrol Selec Pap No 3, p 290-295, 1968. 6 p, 1 fig, 3 tab, 10 ref.

Descriptors: *Paleohydrology, *Alluvial channels, Streamflow, Discharge (Water), Cenozoic era, Sediment transport, Sedimentation, Runoff.
Identifiers: *USSR, Ural Mountains.

To determine the unit runoff from the southeastern slopes of the Urals during the Upper Oligocene-Early Miocene, two methods are used: (1) Comparison of recent and old fluvial forms on the basis of three indexes (slopes of longitudinal profiles, density of the drainage network, and dimensions of meanders) and determination of the ratio of the abundance of water courses responsible for the formation of these forms from empirical formulas relating the form parameters and the channel-forming water discharge; and (2) analysis of the particle-size composition of old alluvium and laboratory determination of the velocities, depth, and discharge of the stream having deposited it. There is good agreement between computations by both methods; the abundance of water in streams having deposited the old alluvium exceeded the recent water abundance by a factor of 10, which corresponds to a unit runoff between 10 and 30 liter/sec sq km. The old rivers resembled the present rivers of Kolkhida in their flow regime. (Knapp-USGS)
W69-10141

HYDROGEOLOGY OF THE UPPER CAPIBARIBE BASIN PERNAMBUCO, BRAZIL A RECONNAISSANCE IN AN AREA OF CRYSTALLINE ROCKS,
Superintendencia do Desenvolvimento do Nordeste (Brazil); and Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W69-10145

THE RECENT 5-YEAR DROUGHT ON SCITUATE WATERSHED AND NEARBY DRAINAGE BASINS IN RHODE ISLAND AND MASSACHUSETTS,
Water Supply Board, Providence, R.I.
Philip J. Holton, Jr.
New England Water Works Association, Vol 83, No 2, p 79-100, June 1969. 22 p, 9 tab.

Descriptors: *Droughts, *Runoff, *Precipitation (Atmospheric), *Water yield, Watersheds (Basins).
Identifiers: *Scituate Watershed in Rhode Island.

This paper examines the five year drought during the period: October 1961 to September 1966. First, the departure from the long term average of rainfall for this five year period is examined in the Scituate and Abbott Run Watersheds, and the Wachusett and Sudburry Watersheds. Then, runoff data in the Scituate Watershed, the Wachusett Watershed, and the Sudbury Watershed are investigated. Next, a comparison of runoff data is made between these three watersheds. The daily yields of all the watersheds are investigated. The final section is a discussion of the data and its relationship to drought given by Ralph M. Soule. (Grossman-Rutgers)
W69-10188

COMPUTERIZED SYSTEM FOR WYOMING SURFACE WATER RECORDS,
Wyoming State Engineer's Office, Cheyenne.
For primary bibliographic entry see Field 07A.
W69-10213

2F. Groundwater

IRMAY'S SATURATION FACTOR AS AN INDICATION OF AN IMMOBILE FRACTION OF PORE WATER IN SATURATED PERMEABLE SANDSTONE,
Geological Survey, Washington, D.C.; Geological Survey, Denver, Colo.; and Bureau of Mines, San Francisco, Calif.
G. E. Manger, R. A. Cadigan, and G. L. Gates.
J Sediment Petrol, Vol 39, No 1, p 12-17, Mar 1969. 6 p, 2 fig, 3 tab, 15 ref.

Descriptors: *Aquifers, *Saturation, *Porosity, *Permeability, *Sandstones, Geology, Capillary water, Acidic water, Igneous rocks, Mathematical studies, Sediments, Gases, Air circulation, Water circulation.
Identifiers: *Saturation factor, Fractional saturation.

The permeability of moderately permeable Jurassic sandstone from the Colorado Plateau as calculated from grain size and other textural parameters agrees reasonably well with that determined experimentally, if calculated permeability is reduced by a factor that reflects fractional saturation with capillary water. This result tends to confirm a conclusion by Irmay that in saturated permeable media a fraction of pore water is shut off from flow of water. Applicability of a saturation factor to poorly permeable sandstone is obscured where acid-soluble contents are high; apparent inapplicability results at very fine grain size perhaps because calculated permeability is not valid where based on very fine grain diameter. (Gabriel-USGS)
W69-09909

GROUNDWATER IN OGALLALA FORMATION IN THE SOUTHERN HIGH PLAINS OF TEXAS AND NEW MEXICO,
Geological Survey, Washington, D.C.
James G. Cronin.
Geol Surv Hydrol Invest Atlas HA-330, 1969. Text 4 map, 1 tab, 25 ref.

Descriptors: *Water resources, *Groundwater, *Aquifers, *Texas, *Groundwater mining, New Mexico, Water supply, Irrigation water, Water levels, Water level fluctuations, Water utilization, Water yield, Water quality, Water wells.
Identifiers: Southern High Plains (Tex-N Mex), Ogallala Formation.

A 4-sheet hydrological atlas shows the current information about the Ogallala aquifer in the Southern High Plains of Texas and New Mexico. Maps scaled 1:500,000 show the saturated thickness of the Ogallala Formation, the altitude of its base, water table altitude, and water level decline since the beginning of heavy pumping for irrigation. A short text included with the maps discusses location and development of the report area, high plains hydrogeology, water quality, and outlook for future water supplies. (Knapp-USGS)
W69-09913

GRAVIMETRIC ESTIMATION OF DEPTH TO AQUIFERS IN THE HAZEVA AREA, ARAVA VALLEY, ISRAEL,
P. R. May.
Israel J Earth-Sci, Vol 17, No 1, p 30-43, Jan 1968. 14 p, 7 fig, 5 ref.

Descriptors: *Groundwater, *Surveys, *Geophysics, *Gravimetry, Gravimeters, Gravity, Gravity studies, Gravimetric analysis, Density, Aquifers, Artesian wells, Limestones, Faults (Geology).
Identifiers: *Israel, Hazeva area, Arava Valley.

Aquifers in the Judea limestone extend from outcrops on the Negev uplands into the Hazeva area in the Arava Valley, Israel and form a continuous artesian system eastward to the western border fault of the Dead Sea graben. A gravity survey shows that the Hazeva area is part of a shallow intermontane basin in which the Judea limestone lies at depths of from less than 100 m in the southwest to 450 m on the east along the border fault of the Dead Sea graben. Within the graben the Judea limestone lies at depths of greater than 1000 m. Between coordinate 018 and 031 north, the western border fault extends approximately north-south along coordinate 117 east, and is mostly concealed beneath Tertiary and Quaternary sediments. On the northwest the Hazeva basin is bounded by a vertical or high-angle thrust fault, and on the southwest by the unfaulted uplift of the Sheza dome. Depth estimations are made at six localities along the bounding faults by direct computation of the parameters of the fault anomaly, namely, the

al anomaly caused by the fault, and the max-
ım residual gradient. The principal density inter-
e in the geologic column occurs at the top of the
lea limestone. The density contrast between the
lea limestone and overlying rocks was deter-
ned from outcrops to be 0.5 gm/cu cm. This con-
st is assumed to be uniform throughout the area.
napp-USGS)
69-09917

RANIUM DISEQUILIBRIUM IN GROUND-
ATER: AN ISOTOPE DILUTION APPROACH
HYDROLOGIC INVESTIGATIONS,
orida State Univ., Tallahassee. Dept. of Geology.
r primary bibliographic entry see Field 02K.
69-09925

RANSIENT STRESSES AND DISPLACEMENT
ROUND A WELLBORE DUE TO FLUID
OW IN TRANSVERSELY ISOTROPIC,
ROUS MEDIA: 2, FINITE RESERVOIRS,
xas Univ., Austin.
r primary bibliographic entry see Field 08E.
69-09926

OCK FAILURE DURING TOOTH IMPACT
ND DYNAMIC FILTRATION,
xas Univ., Austin.
r primary bibliographic entry see Field 08E.
69-09927

OMPARISON BETWEEN ANALOG AND
IGITAL SIMULATION TECHNIQUES FOR
QUIFER EVALUATION,
inois State Water Survey, Urbana.
r primary bibliographic entry see Field 07C.
69-09931

ROUND-WATER RESOURCES OF ESSEX
OUNTY, NEW JERSEY,
eological Survey, Trenton, N.J.
illiam D. Nichols.
J Dep Conserv and Econ Develop, Div of Water
ec Rep No 28, 1968. 56 p, 13 fig, 3 tab, 15 ref.

escriptors: *Water resources, *Groundwater,
New Jersey, Water wells, Aquifers, Water yield,
ater quality, Hydrologic data, Data collections,
ater levels, Water sources.
entifiers: *Essex County (NJ).

roundwater in Essex County, New Jersey occurs
joints and fractures in consolidated rocks and in
rous unconsolidated stratified drift deposits.
ells in sandstone and shale of the Brunswick For-
ation of Triassic age yield from 35 to 820 gpm;
e most productive water-bearing zones are com-
only between depths of 300 to 400 ft. Wells in the
atching basalt, which is intercalated with rocks of
e Brunswick Formation, commonly yield small to
oderate supplies but may occasionally yield up to
0 gpm. Large yields, ranging from 410 to 1,593
m, are common from wells tapping the stratified
ift deposits in the western part of the county.
uality of groundwater is acceptable for most uses
roughout the county. However, heavy pumpage
the Newark area has lowered water levels to
ore than 100 ft below sea level and has reversed
e natural gradient and induced saline water intru-
on. The chloride concentration in the aquifer has
creased since 1951. Highly productive stratified
ift deposits are found primarily west of Second
atchung Mountain. Withdrawals of groundwater
r public supply averaged about 26 mgd in 1966.
mpage for public supply from aquifers in uncon-
lidated sediments averaged 20.9 mgd. Most of
e productive aquifers in Essex County are cur-
ntly being developed. (Knapp-USGS)
69-09933

SE OF THE FINITE ELEMENT METHOD IN
OLVING TRANSIENT FLOW PROBLEMS IN
QUIFER SYSTEMS,
alifornia Univ., Berkeley.

For primary bibliographic entry see Field 07C.
W69-09937

THE AVAILABILITY OF GROUNDWATER FROM THE POTOMAC FORMATION IN THE CHESAPEAKE AND DELAWARE CANAL AREA, DELAWARE,
R. W. Sundstrom.
Del Univ Water Resources Center Rep, June 1967. 95 p, 19 fig, 18 tab, 41 ref. OWRR Proj A-006-ARK.

Descriptors: *Water resources, *Groundwater, *Surveys, *Delaware, Aquifers, Water wells, Water yield, Water quality, Saline water intrusion, Water levels, Groundwater movement, Hydrogeology, Hydrologic data, Data collections.
Identifiers: Chesapeake and Delaware Canal.

The availability of groundwater from the Potomac Formation in the Chesapeake and Delaware Canal area in Delaware was appraised and a family of two drawdown curves was developed. These curves, one for the upper aquifer and one for the lower aquifer of the Potomac, were constructed on the basis of the actual average pumpage from the 2 aquifers by the Tidewater Oil Company during the last several years. Several hypothetical plans of pumping centers, yielding as much as 11 mgd in the Canal area are demonstrated. The drawdown curves presented were developed on the premise that the overall hydrology that applies to Tidewater also applies to other centers of pumping throughout the Canal area. There appears to be no danger of salt water contamination in the reasonably foreseeable future. In the western section of the Canal area in Delaware the Magothy Formation, which is overlain by Pleistocene sands and underlain by the Potomac, crops out in the Canal. The Canal at times contains relatively saline water. The Pleistocene and Magothy in this locality now are protected by the hydraulic gradient toward the Canal. Some contamination might occur to the upper Potomac in this location if the hydraulic gradient were reversed. (Knapp-USGS)
W69-09942

GROUNDWATER RESOURCES OF PAMPANGA PROVINCE,
Philippines Dept. of Public Works and Communications, Manila. Bureau of Public Works.
A. S. Manalac.
Philippines Repub Bur Public Works Groundwater Pap No 1, 1959. 117 p, 12 fig, 2 tab, 10 ref, 7 append.

Descriptors: *Water resources, *Groundwater, *Aquifers, Water yield, Water quality, Water wells, Groundwater movement, Hydrologic data, Data collections, Hydrogeology.
Identifiers: Philippines, Pampanga province.

The Province of Pampanga, Philippines has abundant groundwater supplies. These supplies could be used for agricultural, domestic, municipal and industrial purposes to improve the economy of the province. Large quantities of groundwater are available in deposits of sand which material comprises most of the aquifers. The best aquifers are located about 300 to 700 ft below the ground surface, and their thickness ranges from 100 to 400 ft. These aquifers are generally covered by clay deposits of varying thickness near the land surface. The recharge area is the exposed Bamban formation near the Zambales mountain range which is replenished by rainfall directly percolating to the fountainhead of these aquifers. The general direction of flow is southeast to east. The slope near the mountains is steep but flattens out in the plains. Above the clay deposits are shallow water-table aquifers which store water percolating directly from rainfall and from leaks in the lower artesian aquifers. Most of the dug and drilled wells in Pampanga which are used for domestic purposes draw their supplies from the water-table aquifers. Deeper wells drilled by the National Waterworks and Sewerage Authority derive their water supplies from the confined aquifers. (Knapp-USGS)
W69-09948

IDENTIFICATION OF DISTRIBUTED UNCONFINED AQUIFER PARAMETERS,
California Univ., Los Angeles.
John A. Dracup, Yacov Y. Haimes, and Richard L. Perrine.
Proc, Fourth Amer Water Resources Conf, N Y, p 399-413, Nov 1968. 15 p, 2 fig, 15 ref.

Descriptors: *Aquifers, *Distribution systems, *Transmissivity, *Mathematical models, *Transition flow, Storage capacity, Dimensional analysis.

Transmissivity and storage parameters of wedge-shaped homogeneous regions of a distributed unconfined aquifer system were identified. An analytical solution was approximated to the nonlinear partial differential equation, which governed the transient groundwater flow in an unconfined aquifer. The dimensionality of the distributed parameter problem was reduced by decomposition and multilevel techniques. A direct search method was utilized in the first level, while the Gauss-Seidel type of algorithm was utilized as a second level controller. (Thiuri-Cornell)
W69-10019

INITIAL PERIODICITY OF NEW GEYSER, YELLOWSTONE NATIONAL PARK,
Kansas Univ., Lawrence. Dept. of Geology; and State Univ. of New York, Albany. Atmospheric Sciences Research Center.
Wakefield Dort, Jr., Austin W. Hogan, and G. William Reynolds, Jr.
J Geophys Res, Vol 74, No 17, p 4206-4208, Aug 15, 1969. 3 p, 2 fig, 1 tab.

Descriptors: *Geysers, *Wyoming, Hot springs, Thermal springs, Frequency, Groundwater movement, Timing.
Identifiers: *Yellowstone National Park.

A new geyser, having surface and subsurface connections with the Spectacle Pools, Yellowstone National Park, had a remarkable constant initial periodicity. Eruptive play generally occurred every 35-40 minutes and lasted 80-100 seconds. Water levels and temperatures of the associated pools exhibited consistent variations during each cycle. (Knapp-USGS)
W69-10078

GROUND-WATER LEVELS IN IDAHO, 1969,
Geological Survey, Boise, Idaho.
H. G. Sisco, and R. L. Whitehead.
Idaho Dep Reclam Water Inform Bull No 11, July 1969. 75 p, 93 ref.

Descriptors: *Water levels, *Observation wells, *Idaho, *Data collections, Hydrologic data, Water level fluctuations, Hydrographs.
Identifiers: *Idaho observation well network.

Water levels in water wells of the Idaho observation well network in the water year 1969 are tabulated. Water level changes are shown by hydrographs. Maps show the locations of all network wells, the water levels measured in spring 1969, and water level changes between spring 1968 and spring 1969. (Knapp-USGS)
W69-10081

WATER-LEVEL CHANGES 1964-1968, NORTHERN HIGH PLAINS OF COLORADO,
Geological Survey, Denver, Colo.
Arnold J. Boettcher, and Thomas J. Major.
Geol Surv Open-file Rep, Apr 1969. 3 p, 1 fig, 1 plate.

Descriptors: *Water levels, *Aquifers, *Colorado, *Surveys, Water yield, Irrigation water, Water level fluctuations, Water wells, Discharge (Water).
Identifiers: Ogallala Formation (Colo), High Plains.

Groundwater withdrawals for irrigation nearly quadrupled between 1960 to 1968 in the northern High Plains of Colorado. Groundwater use in-

creased from 82,000 to 308,000 acre-feet per year because of the rapidly growing number of irrigation wells (from 480 wells in 1960 to 1,810 in 1968). Utilization of the resource at this rate has caused significant water-level decline in areas where wells are concentrated and has alerted water managers to the need for an intensive study of the water resources of the area. Such a study was begun in 1968 to provide information for wise administration and management of the resource. Water levels and water-level changes are mapped, based on measurements in 400 wells in the Ogallala aquifer. (Knapp-USGS)
W69-10094

WATER RESOURCES OF THE JOPLIN AREA, MISSOURI,
Geological Survey, Rolla, Mo. Water Resources Div.
G. L. Feder, John Skelton, H. G. Jeffery, and E. J. Harvey.
Missouri Geol Surv and Water Resources Rep No 24, Mar 1969. 97 p, 28 fig, 1 plate, 11 tab, 24 ref, 7 append.

Descriptors: *Water resources, *Groundwater, *Surface waters, *Surveys, *Missouri, Water wells, Streamflow, Springs, Water yield, Water quality, Aquifers, Hydrogeology, Data collections, Hydrologic data, Water sources.
Identifiers: Joplin (Mo).

Water supplies in the Joplin area, Missouri are available from streams, the shallow aquifer (limestone of Mississippian age), and the deep aquifer (dolomite and sandstone of Ordovician and Cambrian ages). The shallow aquifer supplies the baseflow of the area's streams, and also provides some recharge to the deep aquifer. Although recharge to the shallow aquifer occurs within the area, most of the recharge to the deep aquifer occurs outside the area. The average discharge of the area's streams is about 1 billion gpd, and the flow exceeds 150 million gpd 90% of the time. Flooding is not a serious problem at present. Stream water is generally of good quality and is a calcium bicarbonate type. Most wells in the deep aquifer yield 100 to 300 gpm. The water is of good quality, and is a calcium magnesium bicarbonate type with a range in dissolved solids of 140 to 290 (mg/l). Water supplies from the shallow aquifer can be obtained from wells, mine workings, and springs. Yields of wells in the shallow aquifer range from less than 10 gpm to more than 300 gpm. The dissolved-solids content of well water ranges from 162 to 981 mg/1, with a median value of 288 mg/1. The water is generally a calcium bicarbonate type. Due to the poor quality of mine water most uses will be restricted to industry. Disposal of mine water may present a problem to users. There are numerous springs in the area, with many yielding 100 to 500 gpm. The water is generally of good quality. At present about 20 mgd of water is being used in the area, of which about 8 mgd is pumped from streams. (Knapp-USGS)
W69-10095

SURFACE-WATER DISCHARGE AND GROUND-WATER LEVELS IN THE EAST FORK RIVER AREA, SUBLETTE COUNTY, WYOMING,
Geological Survey, Riverton, Wyo.
For primary bibliographic entry see Field 02E.
W69-10097

HYDROGEOLOGY OF THE SCIOTO RIVER VALLEY NEAR PIKETON, SOUTH-CENTRAL OHIO,
Geological Survey, Washington, D.C.
Stanley E. Norris, and Richard E. Fidler.
Geol Surv Water-Supply Pap 1872, 1969. 70 p, 19 fig, 4 plate, 3 tab, 29 ref.

Descriptors: *Hydrogeology, *Alluvium, *Glacial drift. *Ohio, Water supply, Water wells, Transmissivity, Recharge, Water yield, Infiltration, Induced infiltration, Hydrologic data, Data collections. Identifiers: Aquifer tests, Scioto River Valley (Ohio).

A systematic study was made of one of Ohio's principal aquifers, a sand and gravel outwash in the Scioto River Valley, to determine the feasibility of developing a groundwater supply of 20 mgd at a site near Piketon. The thickness and physical properties of the sand and gravel aquifer were determined and test wells were drilled to determine the best sites for supply wells. An aquifer infiltration test was made to determine the hydraulic properties of the aquifer and the conditions of stream recharge. A well 83 ft deep was drilled on the flood plain and was pumped for 9 days at the rate of 1,000 gpm. The effect on the hydrologic system during and after the pumping was determined by measuring the water levels in an array of deep and shallow observation wells and in 8 drive-point wells installed in the bed of the river. Seldom have more comprehensive data been collected showing the effects of pumping on a natural, unconfined, hydrologic system. From these data were calculated the coefficient of transmissibility (215,000 gpd/ft) and the rate of streambed infiltration (0.235 mgd/day/acre/ft). The aquifer was tested near the end of a long drought, so the groundwater levels and the river stage were very nearly following a level trend. (Knapp-USGS)
W69-10105

EFFECT OF TECTONIC STRUCTURE ON THE OCCURRENCE OF GROUND WATER IN THE BASALT OF THE COLUMBIA RIVER GROUP OF THE DALLES AREA, OREGON AND WASHINGTON,
Geological Survey, Washington, D.C.
R. C. Newcomb.
Geol Surv Prof Pap 383-C, p C1-C33, 1969. 33 p, 18 fig, 1 plate, 28 ref.

Descriptors: *Groundwater, *Basalts, *Springs, *Oregon, *Washington, Groundwater movement, Aquifers, Geology, Hydrogeology, Mapping, Porosity, Permeability, Water supply, Water yield, Discharge (Water), Recharge, Columbia River.
Identifiers: The Dalles (Oregon-Wash).

The 620 sq-mi area studied lies across the boundary of the Cascade Range and Columbia Plateaus. The rubbly tops of some of the lava flows and the brecciated flows within the sequence form aquifers that yield large to small amounts of water to wells and springs. The yield of the aquifers depends on the hydrologic conditions and structural situation. Groundwater in the basalt aquifers occurs mainly under three situations: (1) beneath the regional, or main, water table near river level, (2) perched at intermediate altitude near baseleveled secondary streams, and (3) perched at high levels near the top of the basalt in the uplands. Tectonic structure affects groundwater conditions in the basalt by the inclination of the aquifers, by formation of barriers to lateral percolation, by creation of avenues for some vertical movement, and by production of inlets for recharge and outlets for discharge. Together with stratigraphic discontinuities, the structural barriers have caused the impoundment of groundwater in the basalt above the main water table. The levels of the outlets around barriers determine the uppermost level to which the obstructed groundwater rises. The close relation between the tectonic structure and the occurrence of groundwater in the basalt can be used to make better predictions of drilling results. The structural criteria for groundwater storage can be projected elsewhere in the basalt region. An accurate map of the geology, and particularly of the geologic structures, has been found imperative to the interpretation of the groundwater occurrences. (Knapp-USGS)
W69-10107

HYDROLOGY OF A PART OF THE BIG SIOUX DRAINAGE BASIN, EASTERN SOUTH DAKOTA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W69-10110

ASPECTS OF THE OCCURRENCE AN MIGRATION OF NIOBIUM, BERYLLIUM, AN RARE EARTHS IN NATURAL ALKALIN WATERS,
All-Union Scientific Research Inst. of Hydrogeolo gy and Engineering Geology, Moscow (USSR).
For primary bibliographic entry see Field 02K.
W69-10116

ISOTOPIC COMPOSITION OF URANIUM AN ACTINIUM CONTENT IN MINERALS AN NATURAL WATERS,
Akademiya Nauk Kazakhskoi SSR, Alma-Ata; an Akademiya Nauk SSSR, Moscow. Institut Geologi
For primary bibliographic entry see Field 02K.
W69-10117

NATURAL RADIOELEMENTS IN SURFAC AND UNDERGROUND WATERS,
Akademiya Nauk SSSR, Moscow. Institut Geok himii i Analiticheskoi Khimii.
For primary bibliographic entry see Field 02K.
W69-10118

ISOTOPIC COMPOSITION OF HYDROGEN A A CLUE TO THE ORIGIN OF GROUN WATERS AND PETROLEUM,
Ministerstvo Geologii, Moscow (USSR); an Vsesoyuznyi Nauchno-Issledovatelskii Institu Yadernoi Geofiziki i Geokhimii, Moscow (USSR).
For primary bibliographic entry see Field 02K.
W69-10119

ANALYSIS OF DISTRIBUTION OF ARGON I GROUND WATERS,
Vsesoiuznyi Nauchno-Issledovatelskii Institut Ne tekhimicheskikh Protsessov, Leningrad (USSR).
For primary bibliographic entry see Field 02K.
W69-10120

FLUORINE IN THE REGIONALL METAMORPHOSED SKARNS OF THE CZEC MASSIF (CZECHOSLOVAKIAN),
Geological Inst., Jihlava (Czechoslovakia).
For primary bibliographic entry see Field 02K.
W69-10123

ISOTOPIC COMPOSITION OF ARGON I GASES DISSOLVED IN GROUND WATER AN IN THE HYDROCARBON DEPOSITS OF TH EASTERN AND CENTRAL PRECAUCASUS,
Institut Prirodnogo Gaza, Moscow (USSR).
For primary bibliographic entry see Field 02K.
W69-10124

WATER RECORDS OF PUERTO RICO, 1958 63,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W69-10134

LAND SUBSIDENCE ALONG THE DELTA MENDOTA CANAL, CALIFORNIA,
Bureau of Reclamation, Sacramento, Calif.
For primary bibliographic entry see Field 04B.
W69-10135

SUMMARY OF HYDROLOGIC AND PHYSICAL PROPERTIES OF ROCK AND SOIL MATERI ALS, AS ANALYZED BY THE HYDROLOGIC LABORATORY OF THE U.S. GEOLOGICAL SURVEY, 1948-60,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02J.
W69-10143

WATER-BEARING CHARACTERISTICS AN OCCURRENCE OF AQUIFERS IN MARTI COUNTY, NORTH CAROLINA,
Geological Survey, Washington, D.C.
Granville G. Wyrick.

Geol Surv Hydrol Invest Atlas HA-264, 1 sheet, 1967. Text, 1 fig, 1 map, 1 tab.

Descriptors: *Water resources, *Groundwater, *North Carolina, Aquifers, Artesian wells, Permeability, Recharge, Water yield, Water supply, Water wells, Water quality, Hydrogeology, Hydrologic data, Coastal plains.
Identifiers: *Martin County (NC).

The water resources and hydrogeology of Martin County, North Carolina are discussed in a 1-sheet hydrological atlas consisting of a map, tables, and text. Sedimentary rocks underlying Martin County thicken from west to east from about 400 to 1,000 ft. The sediments consist of clay, sand, shell, and limestone of cretaceous to Recent age deposited on crystalline basement rock. Average transmissibility of the artesian aquifers ranges from 4,000 gpd/ft to 18,000 gpd/ft. Average daily recharge is computed as 22 million gpd for aquifers between 100 and 300 ft below land surface. The depth below land surface, thickness, and quality of contained water is given for each principal aquifer in the County at each intersection of a 2-mi grid system, superposed on the county map. Specific capacities of wells tapping each aquifer are given in tables; specific capacities of wells tapping all underlying freshwater aquifers are shown by colors on the map. The text describes geologic units and discussed well-screen sizes for various aquifers. (Knapp-USGS)
W69-10144

HYDROGEOLOGY OF THE UPPER CAPIBARIBE BASIN PERNAMBUCO, BRAZIL A RECONNAISSANCE IN AN AREA OF CRYSTALLINE ROCKS,
Superintendencia do Desenvolvimento do Nordeste (Brazil); and Geological Survey, Washington, D.C.
L. G. C. Filho, M. D. Pessoa, and W. C. Sinclair.
Geol Surv Water-Supply Pap 1663-E, 1966. 44 p, 3 fig, 1 plate, 6 tab, 30 ref.

Descriptors: *Water resources, *Groundwater, Water wells, Aquifers, Water quality, Water resources development, Water supply, Hydrologic data, Hydrogeology, Water yield, Crystalline rocks.
Identifiers: *Brazil, Capibaribe Basin, Pernambuco.

The upper Capibaribe basin is within the Drought Polygon of northeast Brazil, and it totals 5,400 sq km. It receives relatively abundant precipitation, yet is regarded as hot subhumid to semi-arid because the precipitation is uneven from year to year and place to place. The dependable water supply, therefore, is small. The basin has water which could be put to better use than at present, but the opportunities for augmenting the usable supply are not great. The streams are intermittent and therefore cannot be expected to fill surface reservoirs and to keep them filled. The groundwater reservoirs have small capacity. A rough estimate based on the records for 1964 suggests that, of 4,700 million cu m of precipitation in the upper Capibaribe basin, 57% left the basin as runoff and 43% went into underground storage or was evaporated or transpired. The bedrock of the upper Capibaribe basin is composed of granite, gneiss, schist, and other varieties of crystalline rocks, which have only insignificant primary permeability. They are permeable mainly where fractured. A well in a large water-filled fracture zone may yield up to 20,000 liters per hour, but the average well yields less than 1/4 this amount, and some wells yield none. The saprolite contains water locally, but ordinarily will yield only small quantities to wells. The alluvium contains variable amounts of silty sand capable of yielding small to moderate quantities of water to wells. The chemical quality of the water in the upper Capibaribe basin ranges from good to bad and generally presents a major problem. (Knapp-USGS)
W69-10145

USE OF A MATHEMATICAL MODEL IN THE HYDROLOGIC STUDY AS APPLIED TO THE VEGA DE GRENADE OF SPAIN (FRENCH),
F. Mortier, R. G. Thomas, and N. Q. Trac.
Bull Int Ass Sci Hydrol, Vol 14, No 1, p 7-17, Mar 1969. 11 p, 3 fig, 2 tab, 12 ref.

Descriptors: *Mathematical models, *Groundwater basins, Hydrologic properties, *Aquifers, Irrigation, Mapping, Gaging stations, Topography, Water wells, Electrical studies, Piezometers, Depression, River basins, Precipitation (Atmospheric), Infiltration, Tertiary period, Transmissivity, Water storage, Water balance, Water levels, Pumping.
Identifiers: *Spain, The Vega de Grenade.

The mathematical modeling technique developed by the Department of Water Resources of California was applied to the hydrologic study of an aquifer located in the Vega de Grenade, Spain, a basin of 200 sq mi. For the purpose of mathematical modeling, the basin was subdivided into 26 areas of 4.9 to 16.3 sq km and to these subareas were applied to recorded data pertaining to topography, dynamic water level, permeability, storage coefficient, water balance, and pumping data. The application of a mathematical model to the observed hydrologic data requires a relatively small expenditure in money and time, and is capable of identifying reasonably well the pertinent aquifer characteristics. (Gabriel-USGS)
W69-10147

2G. Water in Soils

MEASUREMENT OF WATER PROFILES USING A GAMMA-RAY METHOD (FRENCH),
Department of Agronomical Sciences of the State, Gembloux (Belgium).
For primary bibliographic entry see Field 07B.
W69-09904

MICROWAVE RADIOMETRIC SENSING OF SOIL MOISTURE CONTENT,
Aerojet-General Corp., El Monte, Calif. Space Div.
For primary bibliographic entry see Field 07B.
W69-09916

MOISTURE MOVEMENT TO A FREEZING FRONT,
Army Terrestrial Sciences Center, Hanover, N.H.
Pieter Hoekstra.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Publ No 78, p 411-417, 1968. 7 p, 5 fig, 5 ref.

Descriptors: *Soil water movement, *Freezing, *Mass transport, Diffusion, Clays, Temperature, Porous media, Unsaturated flow.
Identifiers: Temperature gradients, Moisture gradients.

Moisture movement in an unsaturated clay, silt and sand caused by freezing is studied in a laboratory soil column by the attenuation of gamma-radiation. The cumulative water transport from the unfrozen part of the column into the frozen part is directly proportional to the square root of time. The boundary between frozen and unfrozen soil can apparently be treated as a constant soil water tension boundary. By setting the warm plate at 0.1 deg C and the cold plate at -10 deg C a very small temperature gradient exists in the unfrozen part of the column. Nevertheless, moisture migration from the unfrozen into the frozen part of the soil occurs. The moisture movement in the unfrozen part of the column takes place under the influence of a water content gradient. Moisture is redistributed in the frozen part of the soil by movement of water through the liquid-like transitional layer on the particle surfaces. The amount of moisture migration during freezing is of such magnitude that it is of importance in engineering and agriculture. (Knapp-USGS)
W69-09928

EFFECTS OF NEUTRON SOURCE TYPE ON SOIL MOISTURE MEASUREMENT,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 07B.
W69-09986

MEASURING MOISTURE NEAR SOIL SURFACE. . .MINOR DIFFERENCES DUE TO NEUTRON SOURCE TYPE,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 07B.
W69-09987

MECHANICS AND RATES OF NATURAL SOIL CREEP,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 07B.
W69-09988

LEACHABILITY OF A WETTING-AGENT TREATMENT FOR WATER-RESISTANT SOILS,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
J. S. Krammes, and L. F. DeBano.
Soil Sci Soc Amer Proc 31 (5): 709-711, illus, 1967.

Descriptors: *Watershed management, *Erosion control, Soils, Soil conservation, Hydrology, Overland flow, Wettability, Burning, Forest fires.
Identifiers: Southern California, Chaparral watersheds, Wetting agents, Water repellent soils.

Results from a laboratory leaching study showed that the wetting agent treatment persisted after 40 cm. of water had passed through soil samples. (Krammes-Forest Service)
W69-09989

SOIL WETTABILITY: A NEGLECTED FACTOR IN WATERSHED MANAGEMENT,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Jay S. Krammes, and L. F. DeBano.
Water Resources Res, Vol 1, No 2, Second quarter 1965. p 283-286, illus.

Descriptors: *Watershed management, *Infiltration, *Hydrology, Wettability, Erosion, Soils, Floods, Sedimentation, Sediment yield, Soil moisture, Overland flow, Permeability, Burning, Forest fires, California.
Identifiers: *Water repellent soils.

Uneven soil-moisture penetration has been observed and recorded after several southern California wildfires. This condition seems to be associated with an organic coating on the soil particles which makes the soil hydrophobic. (Krammes-Forest Service)
W69-09991

IDENTIFICATION OF DISTRIBUTED UNCONFINED AQUIFER PARAMETERS,
California Univ., Los Angeles.
For primary bibliographic entry see Field 02F.
W69-10019

DEVELOPED EQUATION OF THE WATER BALANCE (POLISH),
For primary bibliographic entry see Field 02A.
W69-10108

ANALYSIS OF VARIATIONS IN SOIL MOISTURE STORAGE IN ROW CROP PLANTINGS AS A FUNCTION OF AGROMETEOROLOGICAL FACTORS,
State Hydrological Inst., Leningrad (USSR).
A. D. Kleshchenko, and Yu. I. Chirkov.

Transl from Trudy Gidro-meteorologcheskogo nauchno-issledovatel' skogo tsentra SSSR, No 14, 1968, p 107-116. Soviet Hydrol Selec Pap No 3, p 270-277, 1968. 8 p, 3 tab, 11 ref.

Descriptors: *Soil moisture, *Soil-water-plant relationships, *Water storage, *Vegetation effects, *Meteorology, Correlation analysis, Regression analysis, Evapotranspiration, Moisture content, Statistical methods, Correlation analysis, Regression analysis.
Identifiers: USSR.

Meteorological observations in Moscow and Kaluga provinces were related to soil moisture content and row crop data by multiple regression analysis. The meteorological data used were air temperature, relative humidity, moisture deficit, wind force, clouds, number of days, with precipitation, and the amount of precipitation. Crop data were leaf surface area, density of planting, stage of plant development and soil moisture, in corn and potatoes. Correlation coefficients were calculated and tabulated. The variation in soil moisture was determined mainly by precipitation, number of rainy days, and cloudiness, and less by the stage of plant development, initial moisture and wind velocity. (Knapp-USGS)
W69-10130

WATER TRANSFER FROM SOIL TO THE ATMOSPHERE AS RELATED TO SOIL PROPERTIES, PLANT CHARACTERISTICS AND WEATHER,
Agricultural Research Service, Riverside, Calif. Salinity Lab.
For primary bibliographic entry see Field 02D.
W69-10136

2H. Lakes

CHEMISTRY OF N AND MN IN COX HOLLOW LAKE,
Florida Univ., Gainesville.
For primary bibliographic entry see Field 05A.
W69-09881

UNSTEADY CIRCULATION IN SHALLOW LAKES,
Cornell Univ., Ithaca, N.Y.
J. A. Liggett.
ASCE Proc, J Hydraul Div, Vol 95, No HY 4, Pap 6686, p 1273-1288, July 1969. 16 p, 7 fig, 10 ref, 2 append.

Descriptors: *Water circulation, *Unsteady flow, *Lakes, Mathematical studies, Model studies, Mathematical models, Winds, Currents (Water), Digital computers.
Identifiers: Lake circulation.

A method is presented for calculating the three-dimensional, unsteady, wind-driven circulation in a shallow, homogeneous lake on a rotating earth. The equations of motion are linearized, boundary friction is assumed to act only on the bottom; and a constant eddy viscosity is assumed. These approximations assume a shallow lake where a characteristic horizontal dimension is large compared to the maximum depth and where the depth is of the order of magnitude of the Ekman 'depth of frictional influence' or less. The solution can be applied to a lake of arbitrary plan form and bottom topography. (Knapp-USGS)
W69-09886

RIVERS AND LAKES OF THE MONGOLIAN PEOPLE'S REPUBLIC (RUSSIAN),
Gidrometeorologicheskii Institut, Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W69-09941

EVOLUTION AND ADAPTIVE RADIATION IN THE CHYDORIDAE (CRUSTACEA: CLADOCERA): A STUDY IN COMPARATIVE FUNCTIONAL MORPHOLOGY AND ECOLOGY,
Freshwater Biological Association, Ambleside (England).
G. Fryer.
Philosophical Transactions of The Royal Society of London, Vol 254, B 795, p 221-385, 1968. 155 fig, 3 tab, 72 ref.

Descriptors: *Crustacea, *Ecology, Lakes, Aquatic habitats, Systematics, Food habits, Niches, Behavior, Phylogeny.
Identifiers: *Comparative morphology, *Evolution, *Adaptive radiation, *Cladocera, *Functional morphology, *Chydoridae, *Comparative studies, Anomopoda, Alonopsis elongata, Acroperus harpae, Camptocercus rectirostris, Alona affinia, Alona, Peracantha truncata, Pleuroxus, Alonella exigua, Alonella excisa, Alonella nana, Disparalona rostrata, Dadaya macrops, Graptoleberis testudinaria, Psuedochydorus globosus, Anchistropus emarginatus, Chydorus, Leydigia leydigii, Monospilus dispar.

Author presents an extensive account of the functional morphology, habits, ecology, and feeding mechanisms of a representative series of anomopod cladocerans of the family Chydoridae, embracing some 22 species belonging to 15 genera. Two genera are here defined as new. The report is said to be the first part of a general survey of Cladocera Anomopoda. Scope of report is indicated by coverage of individual sections as follows: introduction; methods; structure, habits of Anomopoda, especially Chydoridae; structure, habits, feeding mechanism of Alonopsis elongata; structure, affinities, habits of Acroperus harpae; structure, habits of Camptocercus rectirostris; structure, habits, feeding mechanism of Alona affinis; smaller Alona compared; structure, habits, feeding mechanism of Peracantha truncata; two Pleuroxus species compared; structure, habits, feeding mechanism of Alonella exigua; habits, abilities of Alonella excisa compared with A exigua; structure, habits of A nana compared with related species; phyletic divergence of Disparalona rostrata; novel niche of Dadaya macrops; structure habits, feeding mechanism of Graptoleberis testudinaria; structure, habits, feeding mechanism of scavengering Pseudochydorus globosus; structure, habits, feeding mechanism of parasitic Anchistropus emarginatus; exploitation of globular form by Chydorus; mud-adapted Leydigia leydigii; benthic-adapted Monospilus dispar; intergeneric relationships of Chydoridae; and adaptive radiation. (Eichhorn-Wis)
W69-10149

FIELD AND EXPERIMENTAL WINTER LIMNOLOGY OF THREE COLORADO MOUNTAIN LAKES,
Colorado Univ., Boulder. Dept. of Biology.
Robert W. Pennak.
Ecology, Vol 49, No 3, p 505-520, Late Spring 1968. 8 fig, 15 tab, 36 ref.

Descriptors: *Limnology, *Colorado, *Lakes, *Mountains, *Winter, Cyanophyta, Plankton, Copepods, Eutrophication, Oligotrophy, Temperature, Photosynthesis, Rainbow trout, Diatoms, Anaerobic conditions, Algae, Rotifers, Seston, Respiration, Altitude, Sampling, Zooplankton, Phytoplankton, Ice, Bacteria, Tripton, Bottom sediments, Solar radiation, Oxygen, Carbon dioxide, Nannoplankton.
Identifiers: *Field studies, *Experimental limnology, Cladoceran, Montane zone, Alpine zone, Boulder (Colo), Tea Lake (Colo), Black Lake (Colo), Pass Lake (Colo), Micro-algae, Flagellates, Ciliates, Copepodids, Nauplii, Terramycin, Tetracycline, Streptomycin, Millipore filtration, Mesotrophy.

Physical, chemical, and planktonic conditions were studied during two winters in Colorado mountain lakes--Black Lake (mesotrophic), Pass Lake (highly oligotrophic), Tea Lake (shallow, eutrophic, and pondlike). Winter temperatures of lower waters of Black and Pass Lakes are above 4 deg C and as high as 5.4 deg C. Substrate and bottom waters reach equilibrium in late February or March. Thick snow covered Black and Pass Lakes and no photosynthesis occurred for 5-7 months, but Tea Lake had little snow and intermittent photosynthesis during all winter. Black and Pass Lakes are summer-oligotrophic and winter-eutrophic. They became so highly anaerobic by March and April that trout populations died. All three lakes had negligible winter populations of diatoms and green and blue-green algae, but populations of micro-algae attained winter maxima of 1-14.5 million cells per liter, with no consistent seasonal pattern. Winter copepod and cladoceran populations were negligible. Rotifer populations were usually dense, especially during December and January, before onset of anaerobiosis. Seston varied more widely during months of open water. Winter plankton had average respiratory rate in situ of about twice that in corresponding samples kept in dark refrigerator at 3 deg C. (Jones-Wis)
W69-10154

CHANGES IN WESTERN LAKE ERIE DURING THE PERIOD 1948-1962,
Bowling Green State Univ., Ohio.
Jacob Verduin.
Proc of International Assoc of Theoretical and Applied Limnology, Vol 15, p 639-644, Feb 1961. 1 fig, 2 tab, 5 ref.

Descriptors: *Eutrophication, *Lake Erie, Seiches, Sampling, Silts, Nutrients, Light penetration, Physical properties, Phytoplankton, Benthic fauna, Fish, Agricultural watersheds, Detergents, Lakes, Hydrogen ion concentration, Nitrates, Phosphates.
Identifiers: *Lake changes, Lake studies, Chemical changes, Biota changes, Oxygen depletion, Carbon dioxide (Daily changes), Chemical fertilizers, Put-in-Bay (Ohio), Detroit River, Maumee River (Ohio), Maumee Bay (Ohio), Asterionella formosa, Tabellaria fenestrata, Melosira ambigua, Fragillaria capucina, Coscinodiscus radiatus, Melosira binderana, Hexagenia limbata, Tendipes plumosus, Stizostedion vitreum vitreum, Perca flavescens, Osmerus mordax.

Extensive studies of western Lake Erie have been made since 1948. The area of approximately 3100 square kilometers is stirred continually by the seiches resulting in relatively homogeneous temperatures, chemical characteristics, and biological populations vertically. The Detroit River enters the basin's northwest corner contributing most of the water flowing through the lake. The Maumee River enters at the southwest corner, adding most of the silt load and nutrients to the lake. About 100 years ago the land of the Maumee watershed was drained and converted from swamp to agricultural land. In the years from 1948-1962, major changes were observed in the phytoplankton, benthic fauna, and fish communities. Chemical changes also noted include decreasing oxygen saturation near the bottom, increasing pH maxima, increasing carbon dioxide change rates per day, and increasing nitrate and phosphate levels. All these changes suggest an enrichment of western Lake Erie occurring rather sharply between 1949 and 1953. Records of nitrate and phosphate concentrations for the Maumee River show that it contributes significantly greater nutrient supplies to western Lake Erie than it did fifteen years ago. This can be attributed primarily to increased fertilization on farms in the river's watershed. (Ketelle-Wis)
W69-10156

EXTRACELLULAR PRODUCTION IN RELATION TO GROWTH OF FOUR PLANKTONIC ALGAE AND OF PHYTOPLANKTON POPULATIONS FROM LAKE ONTARIO,
Scarborough Coll., Toronto (Ontario).
For primary bibliographic entry see Field 05C.
W69-10158

ON CONTROL OF LAKE EUTROPHICATION: EMPIRICAL AND EXPERIMENTAL INVESTIGATIONS PERTINENT TO THE KNOWLEDGE OF LIMITING CHEMICAL COMPOUNDS IN 46 LAKES OF SWITZERLAND AND BORDER REGIONS-- (IN GERMAN),
Kantonales Laboratorium, Zurich (Switzerland).
For primary bibliographic entry see Field 05C.
W69-10164

SOME FEATURES OF SALINE LAKES IN CENTRAL WASHINGTON,
Washington Univ., Seattle. Dept. of Zoology; and Washington Univ., Seattle. Dept. of Oceanography.
W. T. Edmondson, and George C. Anderson.
Limnology and Oceanography, Vol 10, Supplement, p R87-R96. Nov 1965, 6 fig, 2 tab, 18 ref.

Descriptors: *Washington, *Limnology, *Saline lakes, Arid climates, Radioactivity, Temperature, Salinity, Conductivity, Epilimnion, Thermocline, Sagebrush, Seiches, Tracers, Gamma rays, Depth, Currents (Water), Diffusion, Lakes, Meromixis.
Identifiers: Chemocline, Radioactive rubidium, Soap Lake (Wash), Lower Grand Coulee (Wash), Mixolimnion, Gradient, Monimolimnion, Rubidium-86, Mirabilite.

The central part of the State of Washington has an arid climate and contains a number of saline lakes. Several are meromictic and show a variety of vertical gradients of salinity and temperature. Increased entry of fresh water has diluted mixolimnetic salinity of Soap Lake from 39.4 grams per liter in 1946 to 18.0 in 1964, while the monimolimnion has been maintained at more than 130 grams per liter. Stability of the chemocline was studied by injection of radioactive rubidium. The radioactivity spread laterally in all directions, mostly in a layer less than 2 meters thick, to a maximum observed mean radius of 53 meters in 13 days. The corresponding eddy diffusion coefficient is 3.2 square centimeters per second. Relating to the maintenance of meromixis was an observation that large crystals of mirabilite were found widely distributed on the bottom in contact with the monimolimnion. In the chenocline, there occurred irregular masses of mirabilitie, as much as a decimeter across. Direct measurements were made of currents in the mixoliminion of Soap Lake by SCUBA divers. Currents were observed on two occasions by measuring the spread of dye markers at different depths and locations within the lake. (Jones-Wisc)
W69-10165

SELF-ABSORPTION OF C-14 RADIATION IN FRESHWATER OSTRACODS,
Michigan State Univ., Hickory Corners, W. K. Kellogg Biological Station; and Michigan State Univ., East Lansing. Dept. of Zoology.
Don L. McGregor, and Robert C. Wetzel.
Ecology, Vol 49, No 2, p 352-355, Early Spring 1968. 3 tab, 21 ref.

Descriptors: *Carbon radioisotopes, *Radioactivity, *Fresh water, Crustaceans, Aquatic insects, Oligochaetes, Fish, Tracers, Metabolism, Zooplankton, Larvae, Michigan, Detritus, Phytoplankton, Bacteria, Size, Rotifers, Copepods, Insects, Mollusks, Volume, Life cycles.
Identifiers: *Ostracods, *Self-absorption, Carapace, Gull Lake (Mich), Lawrence Lake (Mich), Species effects, Sexual effects, Instar effects, Reproductive state, Internal structures, Cladocera.

Radiocarbon is being used increasingly in studies of feeding and metabolism of zooplankton, small benthic invertebrates, and larval fish. Radioassays of incorporated carbon-14 are commonly made by counting in solid Geiger-Muller systems. Early investigations with radiocarbon-labeled microinvertebrates indicated or assumed that self-absorption of weak beta radiation was negligible. Subsequent work demonstrates that self-absorption of carbon-14 radiation may be significant even in small organisms and, if neglected in detailed metabolic studies, can lead to substantial errors. Very little is known of nutrition and metabolism of freshwater ostracods. The need for self-absorption coefficients for ostracods developed during course of investigations because of expected high values in organisms whose bodies are entirely enclosed by a calcareous, bivalved carapace. Self-absoption coefficients of carbon-14 radiation, determined for six species of freshwater ostracods, varied with difference in size, sex, instar, reproductive state, and among species. Self-absorption is generally greater in ostracods than in other microcrustacea, some aquatic insects, oligochaetes, and fish larvae. Where carbon-14 is employed as a tracer in precise investigations on feeding and metabolism, variations in self-absorption of radiation must be considered in detail. (Jones-Wis)
W69-10166

ALGAE AND PHOSPHORUS IN LAKE MINNETONKA,
Minnesota Univ., Minneapolis. Limnological Research Center.
For primary bibliographic entry see Field 05C.
W69-10167

ARTIFICIAL EUTROPHICATION OF LAKE WASHINGTON,
Washington Univ., Seattle. Dept. of Zoology.
For primary bibliographic entry see Field 05C.
W69-10169

SEDIMENTS FROM DANISH LAKES,
Copenhagen Univ. (Denmark). Geographical Lab.
Kaj Hansen.
Journal of Sedimentary Petrology, Vol 29, No 1, p 38-46, March 1959. 3 fig, 4 tab, 28 ref.

Descriptors: *Lakes, *Lake soils, *Sediments, Silica, Calcium carbonate, Diatoms, Humus, Water chemistry, Soil chemistry, Palynology, Eutrophication, Oligotrophy.
Identifiers: *Denmark, *Lake typology, Triangle diagrams, Polyhumous lakes, Silicon dioxide (Alkali-soluble), Carbon (Organic), Minerogenic ingredients, Frustules (Diatoms), Ratios (C/N), Evaluation (Methodology).

Analyses of lake muds included determination of organic matter by loss on ignition, inorganic biogenic components as alkali-soluble silicon dioxide and calcium carbonate, and the minerogenic components as the difference between the total and the alkali-soluble silicon dioxide. The two types of humus were delineated on the basis of the organic carbon content (below and above 50%) and carbon-to-nitrogen ratio (below and above 10). The relation between lake types and sediments is indicated by triangular diagrams whose sides represent organic carbon, mineral constituents, and diatom frustules plus calcium carbonate. (Wilde-Wis)
W69-10174

THE IMPORTANCE OF EXTRACELLULAR PRODUCTS OF ALGAE IN FRESHWATER,
University Coll., London (England). Dept. of Botany.
For primary bibliographic entry see Field 05C.
W69-10180

TYPES OF PLANKTIC PRIMARY PRODUCTION IN THE LAKES OF THE EASTERN ALPS AS FOUND BY THE RADIOACTIVE CARBON METHOD,
Biological Station, Lunz am See (Austria).
Ingo Findenegg.
Verh Int Verein Theor Angew Limnol, Vol 15, p 352-359, February 1964. 6 fig, 1 tab, 4 ref.

Descriptors: *Primary productivity, *Lakes, *Carbon radioisotopes, *Plankton, Photosynthesis, Epilimnion, Depth, Distribution, Light intensity, Energy losses, Phytoplankton, Radiation, Oligotrophy, Eutrophication, Algae, Nutrients, Surfaces, Tracers, Limnology.
Identifiers: *Eastern Alps, *Austria, *Lake typology, Carbon assimilation, Metalimnion, Ossiacher See (Austria), Zeller See (Austria), Attersee (Austria), Lunzer See (Austria), Langsee (Austria), Worthersee (Austria), Transparency, Tranmission (Blue light), Area, Traunsee (Austria), Wolfgangsee (Austria), Millstatter See (Austria), Klopeiner See (Austria), Oscillatoria rubescens, Transmission (Green light), Transmission (Red light), Mesotrophy.

Author investigated productivity of Austrian alpine lakes because their variety with regard to geological, morphological, and climatic conditions appeared suitable for this research. Planktonic primary production was measured by the carbon-14 method. Fieldwork, light measurement, counting and volumetrical evaluation of standing crop of plankton, activity measurement and its evaluation were performed. Spectral light-transmission was measured for blue, green, and red wavelengths. In comparing results, three types of curves were observed: In the first case, an extreme or a distinct maximum of assimilation is developed in the upper epilimnion, followed downwards by a more or less rapid decline. The second type shows no distinct maximum. Equally small amounts of carbon are assimilated from the surface down to 5, 8, or even 12 meters, and the photosynthetic layer may be 20 meters thick. This type, most commonly found in lakes of Austrian Alps is generally poor in plankton. The third type shows at least two maxima: one in the epilimnion, another in the metalimnion. Shape of the vertical assimilation curve appears to be much more informative as related to degree of eutrophication than is the amount of organic matter produced per surface unit. (Jones-Wis)
W69-10181

CHANGES IN THE OXYGEN DEFICIT OF LAKE WASHINGTON,
Washington Univ., Seattle. Dept. of Zoology.
For primary bibliographic entry see Field 05C.
W69-10182

2I. Water in Plants

TRANSPORT OF INTERCEPTED SNOW FROM TREES DURING SNOW STORMS,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 02C.
W69-09998

HYDROLOGY OF FOREST LANDS AND RANGELANDS,
Forest Service (USDA), Washington, D.C.; and Agricultural Research Service, Washington, D.C.
For primary bibliographic entry see Field 02A.
W69-10002

REPORT NO. 4: FOREST AND WATER RESEARCH PROJECT, DELAWARE-LEHIGH EXPERIMENTAL FOREST,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station; and Pennsylvania Dept. of Forests and Waters, Harrisburg.
For primary bibliographic entry see Field 02A.
W69-10005

TECHNIQUES IN GRASSLAND WATERSHED RESEARCH,
Forest Service (USDA), Washington, D.C. Div of Watershed, Recreation, and Range Research.
For primary bibliographic entry see Field 02A.
W69-10007

ANNUAL REPORT OF PHREATOPHYTE ACTIVITIES, 1967,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 03B.

W69-10126

ANALYSIS OF VARIATIONS IN SOIL MOISTURE STORAGE IN ROW CROP PLANTINGS AS A FUNCTION OF AGROMETEOROLOGICAL FACTORS,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02G.
W69-10130

ISOTOPIC COMPOSITION OF SULFUR IN AQUATIC PLANTS AND DISSOLVED SULFATES,
Vsesoiuznyi Nauchno-Issledovatelskii Institut Neftekhimicheskikh Protsessov, Moscow (USSR).
For primary bibliographic entry see Field 02K.
W69-10133

WATER TRANSFER FROM SOIL TO THE ATMOSPHERE AS RELATED TO SOIL PROPERTIES, PLANT CHARACTERISTICS AND WEATHER,
Agricultural Research Service, Riverside, Calif. Salinity Lab.
For primary bibliographic entry see Field 02D.
W69-10136

2J. Erosion and Sedimentation

NATURE OF TURBIDITY IN THE ILLINOIS RIVER,
Illinois State Water Survey, Peoria.
Wun-Cheng Wang, and Daniel J. Brabec.
J Amer Water Works Ass, Vol 61, No 9, p 460-464, Sept 1969. 5 p, 7 fig, 1 tab, 17 ref.

Descriptors: *Turbidity, *Rivers, *Illinois, *Water quality, Provenance, Suspended load, Sediment yield, Water chemistry, Soil erosion, Runoff, Nutrients, Streamflow.
Identifiers: *Illinois River.

The major source of turbidity in the Illinois River is soil originating in land runoff. Water turbidity in the Illinois River was found to vary from day to day and from location to location. In general, there was a channel-shallows pattern as well as an upstream-downstream pattern in the study area. Turbidity in the river water was found to be related to the particulate phosphorus, silica, and iron (III) concentrations. The sum of the phosphorus and silica molecules was found to be exactly the same as the iron molecules. A stoichiometric relationship among these parameters is suggested. (Knapp-USGS)
W69-09885

DISPERSION OF FLOATING PARTICLES IN UNIFORM CHANNEL FLOW,
Technical Univ. of Denmark, Copenhagen.
Frank Engelund.
ASCE Proc, J Hydraul Div, Vol 95, No HY 4, Pap 6659, p 1149-1162, July 1969. 14 p, 7 fig, 6 tab, 11 ref, 2 append.

Descriptors: *Dispersion, *Diffusion, *Turbulent flow, *Open channel flow, Steady flow, Hydraulics, Turbulence, Model studies, Mathematical models, Boundary processes, Tracers, Tracking techniques.
Identifiers: Particle dispersion, Floating particles.

An investigation was made of the dispersion of small particles floating on the surface of an open channel with uniform flow and wide rectangular cross section. The dispersion was exclusively due to the diffusion caused by surface turbulence. The surface turbulence is two-dimensional, homogeneous and nondecaying. The dispersion experiments were supplemented by measurements of the turbulence intensities and correlation functions just below the surface of the water. The turbulence was found to be anisotropic, the longitudinal dispersion being nearly twice the lateral dispersion. By the application of an established relation between the Lagrangian and Eulerian correlation functions and a principle of Reynolds' number similarity, a simple description of the one-particle diffusion is obtained. (Knapp-USGS)
W69-09887

INFLUENCE OF SEDIMENTS ON SOLUTE TRANSPORT,
Texas Univ., Austin.
For primary bibliographic entry see Field 05B.
W69-09891

RESISTANCE TO REVERSING FLOWS OVER MOVABLE BEDS,
Technical Univ. of Istanbul (Turkey).
For primary bibliographic entry see Field 02E.
W69-09892

FRICTION-FACTORS FOR FLAT-BED FLOWS IN SAND CHANNELS,
Iowa Univ., Iowa City.
For primary bibliographic entry see Field 02E.
W69-09893

GLACIAL ACCUMULATIONS, DRAINAGE AND ICE RECESSION IN THE NARVIKSKJOMEN DISTRICT, NORWAY,
Uppsala Univ. (Sweden). Dept. of Physical Geography.
For primary bibliographic entry see Field 02C.
W69-09924

SEDIMENTATION IN BROWNELL CREEK SUBWATERSHED NO. 1, NEBRASKA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04D.
W69-09946

SEDIMENT--ITS CONSEQUENCES AND CONTROL,
Agricultural Research Service, Washington, D.C.; and Forest Service (USDA), Washington, D.C.
Louis M. Glymph, and Herbert C. Storey.
Proc Amer Ass Advance Sci Meeting, Agr and Quality of Our Environment Symp, Washington, D.C., Dec 1966. p 205-220.

Descriptors: *Erosion, *Sedimentation, *Soil conservation, *Soil erosion, *Sediment transport, Vegetation effects, Environmental effects, Watersheds (Basins), Watershed management, Reservoir silting, Sediment distribution, Erosion control.
Identifiers: *Sediment movement, Sediment deposition.

After a brief discussion of geologic erosion and modern orogeny, this paper details the consequences of sediment upon fish, recreation, domestic water supply, streams, reservoirs, and estuaries. The next section discusses control of sediment and finally lists 11 areas in which knowledge is lacking. An excellent list of references is included. (Reigner-Forest Ser)
W69-10003

INVESTIGATION OF WATER RESERVOIR BOTTOM DENSITY USING RADIOMETRIC METHODS (POLISH),
Jerzy Makowski, and Andrzej Lewandowski.
Polski Akad Nauk Rozpr Hydrotech, Part 23, p 297-309, 1969. 14 p, 6 fig, 1 tab, 4 ref.

Descriptors: *Bottom sediments, *Density, *Reservoirs, *Radioactivity techniques, Artificial water courses, Sands, Geology, Fissures (Geology), Porosity, Hydraulic properties, Water works, Tracers, Radiochemical analysis, Canals, Currents (Water), Infiltration, Radioisotopes, Rivers.
Identifiers: *Poland, Radiometric methods in hydrology, Water reservoir bottom density.

Because the bottom surfaces of water reservo
often have spots of inferior density subject to e
cessive water infiltration, a radiometric method
suggested as suitable for the detection of the
weak spots. The method consists in the formati
of a uniform layer of radioactive solution over t
reservoir bottom. This layer, on account of
heavier density than the surrounding water layer
precipitated on the reservoir bottom. The botto
spots, characterized by weaker density, absorb
infiltration a considerable amount of radioacti
solution and show relatively smaller radioactive i
tensities on the basis of radioactivity surveys co
ducted after spreading of the radioactive su
stance. The method was tried on the reservoir
the Charna Pshemsha River and found entire
satisfactory. (Gabriel-USGS)
W69-10109

**DEPOSITIONAL ENVIRONMENTS OF SU
SURFACE POTOMAC GROUP IN MARYLAN**
Maryland Geological Survey, Baltimore.
Harry J. Hansen.
Amer Ass Petrol Geol Bull, VOL 53, No 9, p 192
1937, 1969. 15 p, 14 fig, 1 tab, 42 ref.

Descriptors: *Aquifers, *Geologic formatio
*Sedimentation, *Sedimentology, *Sands, San
stones, Alluvium, Flood plains, Deltas, Meande
Electrical well logging, Stratigraphy, Geolog
Hydrogeology, Mesozoic era, Geohydrologic unit
Identifiers: *Potomac Group.

The Potomac Group of Cretaceous age in the Ba
timore-Washington, D.C., area has been reco
nized for many years as a product of fluvial a
paludal sedimentation. The location of Baltimo
near a landward bulge of the Baltimore Canyo
trough, was the locus for fluvial sedimentation
braided or multisotory sands during the time
Patuxent (Barremian) and Patapsco (Albia
deposition. Because of the thickness and perme
bility, those desposits give relatively high coef
cients of transmissibility, between 25,000 a
75,000 gpd/ft. In the context of the classic del
form, the area is the braided upper floodpla
lithofacies of a major axial river syste
Southward, toward the Potomac River, there a
lithofacies associated with a floodplain of meande
ing streams and a fringing swamp zone. Aquifers
those sediments have transmissibility values fro
less than 5,000 to 25,000 gpd/ft. The sand conte
decreases southward from 45% to less than 25%
both the Patuxent and Patapsco Formation
Because of the lack of core data, electric logs a
used to distinguish between the deposits of braid
and meandering streams. (Knapp-USGS)
W69-10113

**EXPERIMENTAL PALEOHYDROLOGIC I
VESTIGATIONS,**
Leningrad State Univ. (USSR). Dept. of Geo
raphy.
For primary bibliographic entry see Field 02E.
W69-10141

**SUMMARY OF HYDROLOGIC AND PHYSICA
PROPERTIES OF ROCK AND SOIL MATER
ALS, AS ANALYZED BY THE HYDROLOGI
LABORATORY OF THE U.S. GEOLOGICA
SURVEY, 1948-60,**
Geological Survey, Washington, D.C.
D. A. Morris, and A. I. Johnson.
Geol Surv Water-Supply Pap 1839-D, p D1-D4
1967. 42 p, 13 fig, 12 tab, 70 ref.

Descriptors: *Hydrologic data, *Data collectio
*Rock properties, Permeability, Specific capaci
Specific gravity, Porosity, Moisture content, Par
cle size, Sands, Silts, Clays, Igneous rocks, Glaci
drift, Metamorphic rocks, Sedimentary rocks, Ca
bonate rocks.
Identifiers: Hydrological Laboratory (USGS).

Summary statistical data are presented on th
results of U. S. Geological Survey Hydrologic

aboratory analyses of the hydrologic and physical properties of rock and soil types from 42 states. This information includes the range, number of rock matrix samples represented, and arithmetic mean. Most analyses are of sedimentary rocks, but details are also provided for igneous rocks, metamorphic rocks, and soil materials. Permeability, porosity, specific gravity of solids, centrifuge-moisture equivalent, and specific retention are listed for weathered granite and gabbro, basalt, sandstone, siltstone, claystone, and shale, silt, clay, loess, eolian sand, tuff, till, washed drift, limestone, dolomite, peat, slate, and schist. (Knapp-USGS)
W69-10143

2K. Chemical Processes

NATURE OF TURBIDITY IN THE ILLINOIS RIVER,
Illinois State Water Survey, Peoria.
For primary bibliographic entry see Field 02J.
W69-09885

OBSERVATIONS OF GASES IN CHESAPEAKE BAY SEDIMENTS,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
William S. Reeburgh.
Limnol and Oceanogr, Vol 14, No 3, p 368-375, May 1969. 8 p, 6 fig, 17 ref.

Descriptors: *Water chemistry, *Estuaries, *Sediments, *Bays, *Gases, Seasonal, Argon, Nitrogen, Carbon dioxide, Methane, Sulfides, Sampling, Biological properties, Water temperature, Analytical techniques, Core drilling, Thermodynamic behavior, Water quality, Mineralogy, Diagenesis.
Identifiers: Chesapeake Bay (Md) sediments.

Seasonal distribution of Ar, nitrogen, methane, and total carbon dioxide in Chesapeake Bay sediments was investigated on the basis of chemical analysis and bore drilling data. The methane contents increase with depth in the sediment from undetected quantities at the surface to concentrations of 150 and 85 ml/liter in water depths of 30.4 and 15.2 m, respectively. Ar and nitrogen are present in the surface sediments in concentrations near that of the overlying water and decrease with depth to values of 0.1 to 2 ml/liter. Stripping by bubbling of methane accounts for the selective removal of nitrogen and the decrease with depth of both Ar and nitrogen contents. Total carbon dioxide increases with depth up to 1,500 ml/liter concentrations. Low values of total hydrogen sulfide and an abundance of acid-labile sulfides in the sediments indicate the removal of sulfides species by mineral forming processes. (Gabriel-USGS)
W69-09900

FORAMINIFERAL SPECIES DENSITIES AND ENVIRONMENTAL VARIABLES IN AN ESTUARY,
Smithsonian Institution, Washington, D.C.
For primary bibliographic entry see Field 02L.
W69-09901

MODERN EVAPORITE DEPOSITION AND GEOCHEMISTRY OF COEXISTING BRINES, THE SABKHA, TRUCIAL COAST, ARABIAN GULF,
California Univ., Riverside.
For primary bibliographic entry see Field 02L.
W69-09906

DISTRIBUTION AND CIRCULATION OF THE MAJOR ELEMENTS IN SURFACE WATERS OF ITALY,
Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
Mario Dall'Aglio.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Publ No 78, p 79-91, 1968. 13 p, 3 fig, 2 tab, 12 ref.

Descriptors: *Trace elements, *Surface waters, *Surveys, Water chemistry, Water analysis, Chemical analysis, Geochemistry, Aqueous solutions.
Identifiers: Italy, Geochemical prospecting.

During the geochemical prospecting surveys for uranium and other elements carried out by C.N.E.N. in Italy, about 5,000 samples of surface waters have been collected on an area of about 50,000 sq kilometers. The surveyed areas are representative of the most important geological formations outcropping in Italy. Determination of temperature, pH, electrical conductance and of the content of Ca, Mg, Na, K, carbonate, sulfate, Cl, and silica were performed on each water sample. Determination of F,B, phosphate, and heavy metals were also performed on about 2,000 water samples. Determination of mercury was performed on about 300 samples of both surface and ground-waters. This gives a good approximation of background values and geochemical behavior. Electrical conductance and the chemical composition of the Italian surface waters were correlated and patterns of distribution were calculated. (Knapp-USGS)
W69-09922

URANIUM DISEQUILIBRIUM IN GROUNDWATER: AN ISOTOPE DILUTION APPROACH IN HYDROLOGIC INVESTIGATIONS,
Florida State Univ., Tallahassee. Dept. of Geology.
J. K. Osmond, H. S. Rydell, and M. I. Kaufman.
Science, Vol 162, p 997-999, Nov 29, 1968. 3 p, 1 fig, 1 tab, 13 ref.

Descriptors: *Water chemistry, *Uranium radioisotopes, *Equilibrium, *Radioactive dating, *Tracers, Aquifers, Florida, Water circulation, Groundwater movement, Karst, Springs, Discharge (Water), Water sources, Mixing.
Identifiers: Floridan aquifer, Isotope dilution analysis.

The distribution and environmental disequilibrium patterns of naturally occurring uranium isotopes U-234 and U-238 in waters of the Floridan aquifer suggest that variations in the ratios of isotopic activity and concentrations can be used quantitatively to evaluate mixing proportions of waters from differing sources. Uranium is probably unique in its potential for this approach, which seems to have general usefulness in hydrologic investigations. (Knapp-USGS)
W69-09925

EVALUATION OF IRREVERSIBLE REACTIONS IN GEOCHEMICAL PROCESSES INVOLVING MINERALS AND AQUEOUS SOLUTIONS--2. APPLICATIONS,
Northwestern Univ., Evanston, Ill. Dept. of Geology.
For primary bibliographic entry see Field 01B.
W69-10092

GEOCHEMICAL EVOLUTION OF OUED SAOURA (NORTHWESTERN SAHARA) WATERS (FRENCH),
Centre de Recherches sur les Zones Arides, Paris (France).
P. Blanc, and G. Conrad.
Rev Geogr Phys et Geol Dyn Paris, Vol 10, No 5, p 415-428, Nov-Dec 1968. 14 p, 6 fig, 4 tab.

Descriptors: *Geochemistry, *Rivers, Streamflow, Floods, Water levels, Water level fluctuations, Discharge (Water), Water supply, Water chemistry, Water circulation, River beds, Water properties, Calcium, Magnesium, Sodium, Potassium, Chlorine, Sulfates, Sediments, Geology, Sands, Gypsum, Clays, Boreholes.
Identifiers: *Africa, *Oued Saoura, Northwestern Sahara.

Geochemical evolution of streamflow waters in the northwestern Sahara were investigated on the basis of geochemical, hydrologic and geologic data recorded in 1965 and 1966. The study shows that in time of a flood, Saoura carries the waters of the Atlas mountains province, supports a narrow band of vegetation in the desert areas of the northwestern Sahara, and carries soluble salts which concentrate at the extreme limit reached by the streamflow. Solid loads carried by streamflows consist of clays and sands and these loads do not modify the streambed morphology because of the short-time periods associated with the flood high-water marks. Salt concentrations are slowly diffused through the alluvium formations and water-bearing formations (aquifers) along the whole course of Oued Saoura, especially in the Melah and Sebhet areas where large accumulations of halite, gypsum, and some carnallite are present. (Gabriel-USGS)
W69-10114

ASPECTS OF THE OCCURRENCE AND MIGRATION OF NIOBIUM, BERYLLIUM, AND RARE EARTHS IN NATURAL ALKALINE WATERS,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
S. R. Kraynov.
Geochem Int, Vol 5, No 2, p 315-325, 1968. 11 p, 6 fig, 5 tab, 22 ref. Transl from Geokhimiya, USSR, No 3, p 342-354, 1968. Published by Geochemical Society.

Descriptors: *Trace elements, *Elements (Chemical), *Aquifers, *Alkaline waters, *Surface waters, Hydrolysis, Mineralogy, Geochemistry, Anion exchange, Lakes, Colloids, Sampling, Chlorine, Calcium, Sulfates, Carbonates, Sodium, Potassium, Salinity, Nitrogen, Humid areas.
Identifiers: Kola peninsula, Central Asia.

Alkaline water samples were collected in the Kola penninsula and Central Asia for the purpose of understanding the occurrence and migration of niobium, beryllium, and rare earths. The migration capacity of a hydrolyzed element in alkaline waters depends on the stability of the complexes formed with the anions in such waters. Nb and rare earths form complexes stable against hydrolysis; Be has a greater tendency to form cations, and its complexes in the supergene zone are stable mainly in acidic and neutral media. (Gabriel-USGS)
W69-10116

ISOTOPIC COMPOSITION OF URANIUM AND ACTINIUM CONTENT IN MINERALS AND NATURAL WATERS,
Akademiya Nauk Kazakhskoi SSR, Alma-Ata; and Akademiya Nauk SSSR, Moscow. Institut Geologii.
N. B. Kadyrov, Ye. A. Isabayev, U. Kh. Asylbayev, A. Kh. Abildayev, and V. V. Cherdyntsev.
Geochm Int, Vol 5, No 2, p 418-419, 1968. 2 p, 1 tab, 8 ref. Transl from Geokhimiya, USSR, No 4, p 492-494, 1968. Published by Geochemical Society.

Descriptors: *Uranium radioisotopes, *Mineralogy, *Surface waters, *Aquifers, Sampling, Sulfides, Oxides, Granites, Spectroscopy, Molybdenum, Electrolysis, Radium radioisotopes.
Identifiers: *USSR, Kazakhstan and Armenia.

The U-234/U-238, U-235/U-238, and Ac-227/Ra-226 ratios in low uranium content sulfide and oxide minerals and in groundwater were investigated on the basis of earlier publications. The U-235/U-238 ratio in all samples varies by less than 1%. Sulfides may be deficient in U-234 by as much as 20%. Groundwater from granite is also enriched in U-234 by as much as 350%. Some minerals sampled are enriched in Ac-237 that does not correlate with U-234 enrichment. (Gabriel-USGS)
W69-10117

NATURAL RADIOELEMENTS IN SURFACE AND UNDERGROUND WATERS,
Akademiya Nauk SSSR, Moscow. Institut Geokhimii i Analiticheskoi Khimii.
V. I. Varanov, N. G. Morozova, T. G. Ikimova, and A. V. Orlova.

Transl from Geokhimiya, USSR, No 3, p 334-341, 1968. For complete transl order Doc G168-3-9 (Varanov) from Amer Geol Inst, 1444 N St, NW, Wash DC, 2005 Price $1.65.

Descriptors: *Aquifers, *Surface waters, *Radioisotopes, Lakes, Rivers, Soil water, Subsoil, Soils, Acid streams, Bogs.
Identifiers: *USSR, Estonian SSR.

Soil-Subsoil waters, lake and river waters of the Estonian SSR were analyzed for their content of radium, uranium and thorium. In all types of surface waters the equilibrium between U- and Ra is lacking. In soil-subsoil waters, lake and river waters the equilibrium is displaced towards U dominance over Ra. In lysimetric soil waters and acid waters of lowland bogs Ra is present in an amount considerably exceeding the equilibrium amount. Surface waters of all types are characterized by Th/U ratio considerably less than one, with the average values varying from 0.1 to 0.4. (Gabriel-USGS)
W69-10118

ISOTOPIC COMPOSITION OF HYDROGEN AS A CLUE TO THE ORIGIN OF GROUND WATERS AND PETROLEUM,
Ministerstvo Geologii, Moscow (USSR); and Vsesoyuznyi Nauchno-Issledovatelskii Institut Yadernoi Geofiziki i Geokhimii, Moscow (USSR).
V. S. Brezgunov, L. S. Vlasova, and V. N. Soyfer.
Transl from Geokhimiya, USSR, No 1, p 86-98, 1968. Published by Geochemical Society. Geochem Int, Vol 5, No 1, p 65-78, 1968. 14 p, 7 fig, 5 tab, 39 ref.

Descriptors: *Groundwater, *Aquifers, *Oil reservoirs, *Hydrogen, Deuterium, Neutron activation analysis, Sodium, Meteoric water, Statistics, Sampling, Geology, Tertiary period, Stagnant water, Surface waters, Water circulation, Salinity, Spectroscopy, Temperature.
Identifiers: *USSR.

Isotopic composition of hydrogen in the ground waters and oil field of the Dnepr-Donets, Irkutsk and other basins of the USSR was investigated using a photoneutron technique. The regularities of distribution of deuterium in natural waters may be used to solve certain hydrogeological problems related to origin of ground waters and their migration. Small variations of about 10% in the deuterium content of petroleum indicate similarity in the isotopic hydrogen content in crude oil progenitors. The concentrations of deuterium in oil field waters are evidently regulated by the same processes as in other types of ground water, and are unrelated to petroleum deposits. (Gabriel-USGS)
W69-10119

ANALYSIS OF DISTRIBUTION OF ARGON IN GROUND WATERS,
Vsesoiuznyi Nauchno-Issledovatelskii Institut Neftekhimicheskikh Protsessov, Leningrad (USSR).
A. N. Voronov, and V. V. Tikhomirov.
Transl from Geokhimiya, USSR, No 1, p 115-118, 1968. For copy of complete transl, order as Doc GI 68-1-15 Transl office, Amer Geol Inst, 1444 N St NW, Wash, DC 20005, Price $1.65.

Descriptors: *Groundwater, *Aquifers, *Argon, *Chemical analysis, Analytical techniques, Atmosphere, Statistical methods, Water chemistry, Correlation analysis.
Identifiers: *USSR.

Single factor variance analysis was applied to 2,000 analyses of argon concentrations in groundwater to estimate what portion of the total variation in reported argon concentrations is due to analytical errors and what portion to variability in nature. The total reported range is 0.01 to 8.0 cu cm/l. The range, eliminating that portion assignable to analytical errors, is 0.08 to 2.44 cu cm/l. This range is still too large to be explained by the hypothesis that argon in groundwater is entirely of atmospheric origin. (Gabriel-USGS)
W69-10120

THORIUM ISOTOPES (Th-230, Th-232) IN THE SURFACE LAYER OF THE INDIAN OCEAN SEDIMENTS,
Yu. V. Kuznetsov, Z. N. Simonyak, A. P. Lisitsyn, and M. S. Frenklikh.
Transl from Geokhimiya, USSR, No 2, p 218-227, 1968. Published by Geochemical Society. Geochem Int, Vol 5, No 1, p 169-177, 1968. 9 p, 3 tab, 16 ref.

Descriptors: *Radiochemical analysis, *Radioisotopes, *Sediments, *Indian Ocean, *Sediment-water interfaces, *Bottom sediments, Sedimentation rates, Chemical analysis, Iron compounds, Manganese, Phosphates, Sampling, Antarctic Ocean, Turbidity currents, Silica, Organic matter, Statistics, Carbon.
Identifiers: Thorium radioisotopes.

The content and distribution of Th-230 and Th-232 in the bottom sediments of the Indian Ocean at depths of 100 to 5,600 m were investigated by radiochemical analysis. The content of ionium (Th-230) in the surface layer of oceanic sediments depends on the depth of water, effective surface areas of the sedimentary particles, and the rate of sedimentation, whereas the dependence of thorium on the same parameters is of complex character. The two isotopes, however, are introduced into the sediments by two different mechanisms: ionium coprecipitates with the hydroxides and phosphates of iron and manganese, and thorium is associated with detrital particles. (Gabriel-USGS)
W69-10121

SILICA IN AQUEOUS SOLUTIONS,
Akademiya Nauk SSSR, Moscow. Institut Geokhimii i Analiticheskoi Khimii.
For primary bibliographic entry see Field 01B.
W69-10122

FLUORINE IN THE REGIONALLY METAMORPHOSED SKARNS OF THE CZECH MASSIF (CZECHOSLOVAKIAN),
Geological Inst., Jihlava (Czechoslovakia).
D. Nemets.
Transl from Geokhimiya, USSR, No 2, p 190-197, 1968. Published by the Geochem Society. Geochem Int, Vol 5, No 1, p 141-147, 1968. 7 p, 1 fig, 5 tab, 7 ref.

Descriptors: *Fluorine, *Metamorphic rocks, *Groundwater, Surface waters, Alkaline water, Water circulation, Geology, Temperature, Chemical analysis, Sampling, Frequency, Mapping.
Identifiers: *Czechoslovakia, Western Moravia.

In the regionally metamorphosed skarns of Western Moravia, the main carriers of fluorine are micas, containing 0.4 - 4.2 weight per cent of fluorine, and common hornblende, with fluorine contents ranging from 1.13 up to 1.5 weight percent. In the pyroxene skarns and acid crystalline schists of the skarn mantle, the fluorine contents vary approximately around the value of 0.1 percent. A considerable share of the fluorine contained now in the skarns was carried there along with water, alkalis and other mobile components in the course of their regional metamorphism. Amphiboles of the West-Moravian amphibolites are considerably poorer in fluorine, which emphasizes the genetic differences between the skarns and amphibolites. (Gabriel-USGS)
W69-10123

ISOTOPIC COMPOSITION OF ARGON IN GASES DISSOLVED IN GROUND WATER AND IN THE HYDROCARBON DEPOSITS OF THE EASTERN AND CENTRAL PRECAUCASUS,
Institut Prirodnogo Gaza, Moscow (USSR).
Ye. Ya. Gavrilov, V. N. Korsenshteyn, Yu. A. Spevak, G. I. Teplinskiy, and A. S. Filin.
Transl from Geokhimiya, USSR, No 1, p 118-121, 1968. Published by Geochem Soc. Geochem Int, Vol 5, No 1, p 89-92, 1968. 4 p, 4 fig, 1 tab.

Descriptors: *Groundwater, *Aquifers, *Oil fiel
*Gases, *Argon, Atmosphere, Water circulatio
Sampling, Mapping, Meteoric water, Structu
geology, Spectroscopy.
Identifiers: *USSR, Caucasus.

Composition of gases dissolved in groundwat
and hydrocarbon deposits of the Stavropol' ar
and the Tersk-Caspian frontal downwarp were i
vestigated by means of isotopic analysis. T
amount of Ar40 in excess of that derived from t
atmosphere may be different in petroleum ga
and in gas dissolved in groundwater associated wi
petroleum deposits. Free gases, gases associat
with petroleum, and gases dissolved in groun
waters may be strongly enriched in radiogenic
gon. Patterns of excess Ar-40 values can sh
direction of movement of sources of groundwat
(Gabriel-USGS)
W69-10124

**DISSOLVED ORGANIC MACROMOLECUL
IN SEA WATER,**
Akademiya Nauk URSR. Inst. of Biology of t
Southern Seas.
K. M. Khaylov.
Transl from Geokhimiya, USSR, No 5, p 595-60
1968. Published by Geochemical Socie
Geochem Int, Vol 5, No 3, p 497-503, 1968. 7 p
fig, 17 ref.

Descriptors: *Organic compounds, *Microbiolo
*Molecular structure, *Dissolved solids, *S
water, Analytical techniques, Gels, Absorptio
Humic acids, Proteins, Peptides, Amino acids, H
mus, Dehydration.
Identifiers: *USSR, Kola Peninsula.

A method is presented for the emulsion-extracti
of high molecular weight compounds from s
water. Fractionation of the extract on the basis
molecular weights is conducted by gel filtration
Sephadex. The compounds separated genera
have molecular weights up to 200,000 and some
the material is adsorbed, indicating the presence
aromatic groups. The properties of the compoun
are not the same as those of humic substances fro
soils or rivers. The macromolecules may dehydra
for form particulate matter in the sea. (Gabri
USGS)
W69-10125

**ISOTOPIC COMPOSITION OF SULFUR I
AQUATIC PLANTS AND DISSOLVE
SULFATES,**
Vsesoiuznyi Nauchno-Issledovatelskii Institut Ne
tekhimicheskikh Protsessov, Moscow (USSR).
V. L. Mekhtiyeva, and R. G. Pankina.
Transl from Geokhimiya, USSR, No 6, p 739-74
1968. Published by Geochemical Socie
Geochem Int, Vol 5, No 3, p 624-627, 1968. 4 p,
tab, 7 ref.

Descriptors: *Sulfur, *Stable isotopes, Aquat
plants, *Dissolved solids, *Sulfates, *Sea wate
Organic compounds, Salinity, Amino acids, Ba
teria, Chemical analysis, Sedimentation.
Identifiers: *USSR, Black Sea.

The isotopic composition of sulfur in 15 aquat
plants was investigated on the basis of sampl
taken from the Uchinsk reservoir (4 plants
Moscow River (4 plants), and Golubaya Bay of t
Black Sea (7 plants), and compared with that
sulfate dissolved in the same waters. The sulfur
the marine plants cannot be the sole source of o
ganic sulfur in marine sediments. (Gabriel-USGS)
W69-10133

**A TABLE FOR CONVERTING pH T
HYDROGEN ION CONCENTRATION (H-
OVER THE RANGE 5-9,**
Civil Aeromedical Inst., Oklahoma City, Okla.
Vincent Fiorica.
Available from the Clearinghouse as AD-688 12
for $3.00 in paper copy, 0.65 in microfich

Federal Aviation Admin, Aviation Medical Report, AM 68i23, 32 p, Oct 1968. 7 ref.

Descriptors: *Hydrogen ion concentration, Water chemistry, Physiological ecology, Digital computers, Data collections, Data processing.
Identifiers: *Conversion tables.

Recent developments in physiology make utilization of hydrogen-ion concentrations more appropriate than the conventionally used pH. With increasing use of expressions of concentration, more frequent interconversion between the two systems of notation will be required. This report presents tables, prepared from photographic reproduction of computer print-outs, of hydrogen-ion concentrations (in nanno-equivalents/liter expressed to five significant digits) for arguments of pH between 5 and 9 in increments of 0.001 unit. (Eichhorn-Wis)
W69-10148

OCCURRENCE OF SULFATE AND NITRATE IN RAINFALL,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W69-10153

RELATIONSHIP OF AVAILABILITY OF PHOSPHORUS AND CATIONS TO FOREST SUCCESSION AND BOG FORMATION IN INTERIOR ALASKA,
Alaska Univ., College.
Paul E. Heilman.
Ecology, Vol 49, No 2, p 331-336, Early Spring 1968. 1 fig, 5 tab, 10 ref.

Descriptors: *Nutrients, *Phosphorus, *Cations, *Bogs, *Alaska, Manganese, Carbon radioisotopes, Radioactive dating, Trace elements, Permafrost, Radioecology, Forests, Nitrogen, Potassium, Calcium, Magnesium.
Identifiers: *Nutrient availability, *Forest succession, *Bog formation, Picea mariana, Sphagnum, Site index, Black spruce, Zinc, Spruce-sphagnum, Foliar concentrations.

The decrease in site index of black spruce, Picea mariana, was paralleled by a lower foliar concentration of nitrogen, phosphorus, and potassium. The least concentration of nutrients was found in trees supported by sphagnum peat over permafrost. Radiocarbon dating indicated that a 41-71 centimeter layer of sphagnum peat, weighing 270,000-510,000 kilograms/hectare, had accumulated in less than 185 years. The average annual increase in thickness of peat deposits was estimated between 0.25 and 0.38 centimeters. The average annual increment of organic matter on oven-dry basis varied between 1,500 and 2,800 kilograms/hectare. (Wilde-Wis)
W69-10172

CHANGE IN DISTRIBUTION AND AVAILABILITY OF NITROGEN WITH FOREST SUCCESSION ON NORTH SLOPES IN INTERIOR ALASKA,
Alaska Univ., College.
Paul E. Heilman.
Ecology, Vol 47, No 5, p 825-831, Late Summer 1966. 5 fig, 2 tab, 11 ref.

Descriptors: *Nitrogen, *Forests, *Alaska, *Cycling nutrients, Burning, Permafrost, Ecosystems, Forest management, Forest soils.
Identifiers: *Forest succession, Picea mariana, Betula papyrifera, Sphagnum, Fairbanks (Alaska), Birch-spruce ecosystems, Soil evolution, Black spruce, Ratio (C/N), Nutrient deficiencies, Burning effects.

Encroachment of sphagnum species on north-facing slopes of interior Alaska decreases availability of nitrogen and converts reasonably productive birch-spruce ecosystems into raised peat bogs supporting non-merchantable black spruce. The insulating effect of sphagnum induces rising of the permafrost which at times is only 15 inches below the surface. Burning the surface moss layer exposes nitrogen-enriched substratum, increases soil temperature, moderates acidity, and enhances availability of nutrients. (Wilde-Wis)
W69-10173

OXYGENATION OF IRON (II) IN CONTINUOUS REACTORS,
North Carolina Water Resources Research Inst., Raleigh.
For primary bibliographic entry see Field 05D.
W69-10293

2L. Estuaries

STOCHASTIC MODEL FOR BOD AND DO IN ESTUARIES,
Virginia Polytechnic Inst., Blacksburg, Va.
For primary bibliographic entry see Field 05B.
W69-09879

OBSERVATIONS OF GASES IN CHESAPEAKE BAY SEDIMENTS,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
For primary bibliographic entry see Field 02K.
W69-09900

FORAMINIFERAL SPECIES DENSITIES AND ENVIRONMENTAL VARIABLES IN AN ESTUARY,
Smithsonian Institution, Washington, D.C.
Martin A. Buzas.
Limnol and Oceanogr, Vol 14, No 3, p 411-422, May 1969. 12 p, 10 fig, 6 tab, 18 ref.

Descriptors: *Plankton, *Aquatic microorganisms, *Estuaries, *Maryland, *Estuarine environment, *Biology, Rivers, Sampling, Water temperature, Salinity, Oxygen, Chlorophyll, Statistical methods, Food abundance, Nutrients, Marine animals, Stations, Parametric hydrology.
Identifiers: Foraminifera, Choptank River.

Foraminiferal species densities (Elphidium clavatum, Ammobaculites exiguus and Ammonia beccarii) in the Choptank River estuary of Maryland were investigated by a detailed analysis of samples collected for 1 yr at 3 selected stations. Each station was sampled monthly for foraminiferal density, temperature, salinity, oxygen and chlorophyll contents. A general multiple regression-analysis model containing parameters for environmental variables, station differences, overall periodic differences, and the interaction of stations was statistically compared to several more restricted models. All 3 species exhibit periodicity, and for each species the periodicity is different at the 3 stations. The relatively large values of the regression coefficients for the chlorophyll suggest that the amount and kind of available food is important in determining species densities. (Gabriel-USGS)
W69-09901

MODERN EVAPORITE DEPOSITION AND GEOCHEMISTRY OF COEXISTING BRINES, THE SABKHA, TRUCIAL COAST, ARABIAN GULF,
California Univ., Riverside.
Godfrey P. Butler.
J Sediment Petrol, Vol 39, No 1, p 70-89, Mar 1969. 20 p, 8 fig, 2 tab, 31 ref.

Descriptors: *Deposition (Sediments), *Halides, *Geochemistry, *Brines, Water chemistry, Chemical analysis, Geology, Anhydrite, Gypsum, Dolomite, Sulfates, Carbonates, Pleistocene rocks, Recent epoch, Magnesium, Calcium, Temperature, Climates.
Identifiers: *Arabian Gulf, *Evaporite deposition.

Evaporite deposition and geochemistry of coexisting brines on the Trucial Coast of the Arabian Gulf was investigated on the basis of field studies and analysis of 260 interstitia brine samples. The brines and diagenetic evaporate minerals (aragonite, guysum, halite, anhydrite) show zonation based on the frequency of periodic flooding by sea waters. The present elevation of evaporite development in the Sabkha is determined by the level of flood water above the level of high tide. Most of the anhydrite in the Sabkha is of secondary origin. The Mg/Ca balance of evaporites is controlled by both evaporation and dolomitization. Three major diagenetic facies occur in the Sabkha. The similarity between the stratigraphy and mineralogy of some Ordovician, Silivian, Pennsylvanian, and Jurassic sequences in the Sabkha suggests that evaporites of supratidal origin may be more common in older evaporite rocks than previously realized. (Gabriel-USGS)
W69-09906

ARAGONITE-CEMENTED SANDSTONE FROM OUTER CONTINENTAL SHELF OFF DELAWARE BAY: SUBMARINE LITHIFICATION MECHANISM YEILDS PRODUCT RESEMBLING BEACHROCK,
Bell Telephone Labs., Inc., Chester, N.J.; Rennselaer Polytechnic Inst., Troy, N.Y. Dept. of Geology; and Columbia Univ., Dobbs Ferry, N.Y. Hudson Labs.
R. C. Allen, E. Gavish, G. M. Friedman, and J. E. Sanders.
J Sediment Petrol, Vol 39, No 1, p 136-149, Mar 1969. 14 p, 10 fig, 3 tab, 41 ref.

Descriptors: *Lithification, *Sandstones, *Continental shelf, *Atlantic Ocean, Algae, Organic matter, Climates, Tropical regions, Marine animals, Carbon, Methane, Sea level, Marshes, Salinity, Radioactivity, Microorganisms, Geochemistry, Diagenesis.
Identifiers: Delaware Bay shelf, Submarine lithification.

A shelly sandstone containing a modern microfauna recovered from the outer shelf off Delaware Bay (79 m depth) was cemented by cryptocrystalline and fibrous aragonite and other constituents. The fossils in the sandstone are of species living in cooler water than that off the present New Jersey coast. The textural relationships of the aragonite cement and algae borings in the sandstone are identical with those of many modern beachrocks. (Gabriel-USGS)
W69-09908

NUMERICAL SIMULATION OF WAVE-CREST MOVEMENT IN RIVERS AND ESTUARIES,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W69-09919

INFRARED EXPLORATION FOR COASTAL AND SHORELINE SPRINGS,
Stanford Univ., Calif. Dept. of Mineral Engineering; and Stanford Univ., Calif. Dept. of Geology.
For primary bibliographic entry see Field 07B.
W69-09932

THORIUM ISOTOPES (Th-230, Th-232) IN THE SURFACE LAYER OF THE INDIAN OCEAN SEDIMENTS,
For primary bibliographic entry see Field 02K.
W69-10121

A METHOD FOR THE DETERMINATION OF ZERO THICKNESS ACTIVITY OF CARBON-14 LABELED BENTHIC DIATOMS IN SAND,
Marine Lab., Aberdeen (Scotland); and Michigan State Univ., Hickory Corners. W. K. Kellogg Biological Station.
I. E. Baird, and R. G. Wetzel.

Limnology and Oceanography, Vol 13, No 2, p 379-382, Apr 1968. 1 fig, 2 tab, 4 ref. AEC AT (11-1)1599, COO-1599-4.

Descriptors: *Benthic flora, *Diatoms, *Carbon radioisotopes, *Sands, *Radioactivity, Epilimnion, Sampling, Sea water, Background radiation, Particle size, Waves (Water).
Identifiers: Production rates, Scotland, Firemore Bay (Loch Ewe), Phaeodactylum, Shell gravel, Gas phase, Geiger-Mueller counter, Loch Ewe (Scotland).

An ecology study of Firemore Bay, a sandy bay in Loch Ewe off the coast of northwestern Scotland, led to the development of methods for measurement of production rates by benthic diatoms. The methods described for estimating these rates of the epilithic sand flora apply to those littoral areas where effectively all the flora are attached to the sand grains and where the natural disturbance of the sand surface by wave action permits mixing of the samples before and after incubation. The effect of the sand disturbance during incubation was tested by shaking samples every 15 minutes for four hours; these gave slightly lower and more variable results than did unshaken samples. Thus, movement of the sand does not appear to enhance production rates. Within the limits of error described, radioassay in gas phase can be replaced by the simpler end-window Geiger-Mueller method. Use of an ordinary culture for calibration of this method does not give significantly different results from those using a true benthic diatom. Consequently, this method provides a simple way of calibrating the normal instrumentation used for carbon-14 determinations to estimate production rates by attached diatom populations of sandy beaches. (Jones-Wis)
W69-10150

THE HABITAT OF LEUCOTHRIX MUCOR, A WIDESPREAD MARINE MICROORGANISM,
Indiana Univ., Bloomington. Dept. of Bacteriology.
For primary bibliographic entry see Field 05C.
W69-10161

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3B. Water Yield Improvement

FORESTS--NATIONAL SUPPLIES AND DEMANDS FOR WATER,
Forest Service (USDA), Washington, D.C. Div. of Watershed, Recreation, and Range Research.
Herbert C. Storey, and Irvin C. Reigner.
Proc Soc Amer Foresters Meeting (1966), p 143-146, 1967.

Descriptors: *Watershed Management, *Water yield improvement, *Water supply, *Water demand, *Vegetation effects, Elasticity of supply, Water sources, Consumptive use, Evapotranspiration, Rainfall-runoff relationships, Droughts, Water distribution (Applied).

Rainfall and runoff across the U.S.A. is sufficient to meet the water demands in the foreseeable future, but both supplies and demands are poorly distributed. More water can be made available at low cost by increasing the yield of water sources now in use. A significant contribution can be made by manipulating the vegetation on wildlands. Estimates of increased yield are presented region by region with general recommendations on how to achieve them.
W69-10004

ANNUAL REPORT OF PHREATOPHYTE ACTIVITIES, 1967,
Bureau of Reclamation, Denver, Colo.
P. M. Turner.
Bur Reclam, Water Conserv Br Div Res Rep No WC-48, Oct 1968. 38 p, 1 fig, 15 tab, 21 ref, append.

Descriptors: *Phreatophytes, *Evapotranspiration, *Evapotranspiration control, Water yield improvement, Water resources, Water conservation, Semiarid climates, Lysimeters, Herbicides, Surfactants, Chemcontrol, Tamarisk.
Identifiers: Bureau of Reclamation phreatophyte studies.

Bureau of Reclamation activities on phreatophyte research and control are described. Regional research contracts have been negotiated with the Universities of Arizona and Nevada. At Denver saltcedar plants are greenhouse- and nursery- cultured and used as test specimens for foliar-applied herbicides. Herbicide evaluation plots were established along the Arkansas River near North Avondale, Colo. Helicopter herbicide spraying was performed on about 250 acres of saltcedar around Rye Patch Reservoir, and about 100 acres were sprayed by fixedwing aircraft by Pershing County Water Conservation District. About 16,000 acres of phreatophytes were cleared in the Colorado Indian Reservation near Parker, Ariz., by lessees. Phreatophytes were controlled by tree crusher, root plow, cutter dozer, and spraying on about 12,700 acres along the Pecos River in New Mexico. Phreatophyte vegetation along the Arkansas River between Pueblo, Colo, and Great Bend, Kans., has been surveyed by Colorado State University and Fort Hays Kansas State College under Region 7 contract. (Knapp-USGS)
W69-10126

3D. Conservation in Domestic and Municipal Use

LINEAR PROGRAMMING OF WATER TRANSFERS IN THE NEW YORK METROPOLITAN REGION,
Rutgers - The State Univ., New Brunswick, N.J.; Barnard Coll., New York; and Columbia Univ., New York.
For primary bibliographic entry see Field 06A.
W69-10023

FUTURE SUPPLIES OF WATER FOR DOMESTIC USE.
For primary bibliographic entry see Field 06E.
W69-10039

3E. Conservation in Industry

WATER USE IN THE PETROLEUM AND NATURAL GAS INDUSTRIES,
Bureau of Mines, Washington, D.C. Div. of Statistics.
For primary bibliographic entry see Field 06D.
W69-09944

3F. Conservation in Agriculture

STUDY OF IRRIGATION BY SPRINKLING (FRENCH),
Department of Agronomical Sciences of the State, Gembloux (Belgium).
J. Dendas, and A. Bentz.
La Trib du Cebedeau. Vol 22, No 305, p 191-195, Apr 1969. 5 p, 1 fig, 6 tab, 3 ref.

Descriptors: *Irrigation practices, *Spraying, *Agriculture, Agricultural engineering, Vegetable crops, Evapotranspiration, Evaporation, Lysimeters, Water loss, Temperature, Humidity, Statistical methods, Water utilization, Beans.
Identifiers: Irrigation by sprinkling.

On the basis of the Turc formula and the application of statistical techniques developed by Bumbel, the value of irrigation by sprinkling was investigated. Sprinkling was carried out from 1951 to 1965 on sugar beet and vegetable crops. The discussion includes: (1) terminology and definitions; (2) land irrigation trials; (3) sugar beets irrigation trials; (4) vegetable irrigation trial; and (5) the conclusions. The application of a hydraulic potential deficit concept and by sprinkling lead to a reliable evaluation of the water supply and to an increase in production of vegetables and sugar beets. (Gabriel-USGS)
W69-09903

DYNAMICS OF OBJECTS IRRIGATORY SYSTEMS REGULATION,
Frunze Polytechnic Inst. (USSR).
E. E. Makovskey.
IFAC, Haifa Symp, Comput Contr Nat Resources Public Util, p 2-16, Sept 1967. 16 p, 1 tab, 1 fig, ref.

Descriptors: *Mathematical models, *Irrigation efficiency, *Optimization, *Water supply, *Unsteady flow, Hydraulic design, Analogue computers, Systems analysis, Canal construction, Automatic control, Water conveyance.

The application of mathematical techniques for solving irrigation water supply problems in regions with insufficient water reserve was discussed. The objective of the study was to define optimal systems for connecting water consumers with the irrigation system and the possibility of providing them with water irrespective of its flow and velocity in the system. Linear approximation techniques were employed. The appropriate analytical methods of approximate description in general terms of functional dependence of transient characteristics upon hydraulic canal parameters and hydrotechnical constructions were of particular importance because these methods secured the required precision. Discussed were possibilities of using analogue computers for solvingproblems of physically modelling cascade water regulation system. (Thiuri-Cornell)
W69-10025

ARKANSAS IRRIGATION, DRAINAGE AND WATERSHED IMPROVEMENT DISTRICT ACT OF 1949.
For primary bibliographic entry see Field 06E.
W69-10065

AN ENGINEERING-ECONOMIC ANALYSIS OF SYSTEMS UTILIZING AQUIFER STORAGE FOR THE IRRIGATION OF PARKS AND GOLF COURSES WITH RECLAIMED WASTEWATER.
Nevada Univ., Reno. Coll. of Engineering.
Richard G. Orcutt.
Engineering Report No. 7, Center for Water Resources Research, Desert Research Institute, University of Nevada, Oct 1967. 123 p, 17 fig, 12 tab, 3 append, 47 ref.

Descriptors: *Irrigation, *Water types, *Model studies, Computer programs, Golf courses, Parks.
Identifiers: *Las Vegas (Nev), *Hele-Shaw Model, *Aquifer storage.

A generalized computer program for computing the production costs of systems utilizing aquifer storage for irrigation purposes with reclaimed waste water was developed. A sensitivity analysis was performed by observing the effects on varying the values of input parameters, which represented decision variables and constants with uncertain values, upon the cost of producing reclaimed water. Preliminary feasibility studies were conducted in Las Vegas, Nevada. The model enables the analyst to rapidly determine the effect of varying about forty input parameters on the cost of water production. An appendix on 'The Design of A Hele-Shaw Model', from a thesis by Donald L. Clark is included. The computer program (Fortran language) is also included. (Grossman-Rutgers).
W69-10187

RRIGATION WITH RESTRAINTS ON LAND ND WATER RESOURCES,
ansas State Univ., Manhattan. Dept. of conomics.
Vilfred H. Pine, and Amar S. Sirohi.
and Economics, Vol 45, No 2, p 285-287, May 969. 3 p, 1 tab, 2 ref.

escriptors: *Irrigation efficiency, *Irrigation permits, *Mathematical studies, Subsurface waters.
dentifiers: *Kansas, *Production functions.

n Kansas a permit is required to use water for ther purposes than domestic uses, so that priorities may be implemented in case of shortages. The older of the permit is allowed to withdraw a quanty equal to or in excess of the economic optimum. he cost of withdrawal and application of groundater for irrigation are the major restraints. In maxnizing profits water is applied to land until the roduct from the last unit of water exceeds the osts of that unit of water. If the water supply is exausted by the optimal rate, the irrigator and ociety must decide on the quantity of water to be sed. This report shows that with prevailing costs nd prices and conditions of limited total water, opmal irrigation would call for about twice as much nd with one-half as much water per acre as comared with optimal irrigation with no limitation on ater. (Grossman-Rutgers)
/69-10189

ORKSHOP ON WATER RESOURCE ROBLEMS AND RESEARCH NEEDS RE-ATED TO AGRICULTURE IN THE COASTAL LAINS OF NORTH CAROLINA.
orth Carolina Water Resources Research Inst., aleigh.

avid H. Howells, (Editor). WRRI-UNC Report o. 27, March 14, 1969, 31p. OWRR Contract 14-1-0001-1853.

escriptors: *Agriculture, *Drainage, *Irrigation, Pesticides, *Fertilizers, Wildlife management, Animal wastes, Water quality, Groundwater echarge.
dentifiers: North Carolina.

he objectives of this workshop were to: explore nd characterize problems associated with land rainage, irrigation, agricultural chemicals, animal nd human wastes, and farm water supplies; identi- and define specific research needs directed to ecognized problems; and suggest priorities among lentified research needs. Participants included niversity research and extension staff, representaves of state and federal agencies and private inustry, county extension chairmen and farmers. heir fields of interest encompassed agriculture, orestry, planning, water resource management, ublic health and conservation. While the initial orkshop directed its attention to the Coastal Reion, this report is generally applicable to the state s a whole. Copies of the report draft were circuted to all County Extension Chairmen throughout he state. Comments were received from 13 addiional counties in the Coastal Region, 16 in the iedmont and 6 in the Mountain Region, and are ummarized in this report. There was general greement with the initial report except for minor mphasis on drainage problems outside the Coastal egion. Each participant was asked to assign a nuerical priority to the research needs identified uring the workshop. Those with an average in exess of 2.5 on the 1 to 5 scale were dropped and the emaining needs listed in order of priority. Additional suggestions concerning research needs were dded during review of the draft and these were sted separately. This report will be used by the Initute as a guide to the development of its research rogram in the field of agricultural water use. Its mitations are recognized, however, and every enouragement is given to the flow of new ideas of romise which escaped recognition at this time.
/69-10294

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

BASIC DATA REPORT NO 3 FOR RESEARCH ON FLOOD FREQUENCY FOR SMALL DRAINAGE AREAS,
Geological Survey, Jackson, Miss.
For primary bibliographic entry see Field 02E.
W69-09895

FLOODPLAIN INFORMATION, FIVE MILE CREEK, METROPOLITAN BIRMINGHAM, ALABAMA.
Corps of Engineers, Mobile, Ala.

Corps Eng Floodplain Rep, June 1969. 33 p, 7 fig, 16 plate, 10 tab.

Descriptors: *Floods, *Flood damage, *Alabama, *Floodplains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Birmingham (Ala), Standard project flood, Intermediate regional flood.

Flooding of Metropolitan Birmingham, Alabama is described in a report of floodplain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of floodplain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-09896

FLOODPLAIN INFORMATION, SWEETWATER, JACKSON, CAMP, BEAVER RUN, AND BROMOLOW CREEKS, METROPOLITAN ATLANTA, GEORGIA.
Corps of Engineers, Savannah, Ga.

Corps Eng Floodplain Rep, June 1969. 70 p, 34 fig, 53 plate, 19 tab.

Descriptors: *Floods, *Flood damage, *Georgia, Floodplains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Atlanta (Ga), Standard project flood, Intermediate regional flood.

Flooding of Metropolitan Atlanta, Georgia is described in a report of floodplain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of floodplain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-09897

FLOODPLAIN INFORMATION, FOURCHE CREEK AND TRIBUTARIES, LITTLE ROCK, ARKANSAS - PART 1.
Corps of Engineers, Little Rock, Ark.

Corps Eng Floodplain Rep, June 1969. 42 p, 22 fig, 35 plate, 11 tab.

Descriptors: *Floods, *Flood damage, *Arkansas, Floodplains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Little Rock (Ark), Standard project flood, Intermediate regional flood.

Flooding of Little Rock, Arkansas is described in a report of floodplain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of floodplain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-09898

HYDROLOGY OF FOREST LANDS AND RANGELANDS,
Forest Service (USDA), Washington, D.C.; and Agricultural Research Service, Washington, D.C.
For primary bibliographic entry see Field 02A.
W69-10002

SEDIMENT--ITS CONSEQUENCES AND CONTROL,
Agricultural Research Service, Washington, D.C.; and Forest Service (USDA), Washington, D.C.
For primary bibliographic entry see Field 02J.
W69-10003

PREDICTION MODELS FOR INVESTMENT IN URBAN DRAINAGE SYSTEMS,
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
For primary bibliographic entry see Field 06A.
W69-10011

CONJUNCTIVE USE OF GROUND AND SURFACE WATERS,
California State Dept. of Water Resources, Los Angeles.
For primary bibliographic entry see Field 06A.
W69-10012

DAMS.
For primary bibliographic entry see Field 06E.
W69-10027

CANALS AND WATERWAYS, RIVERS, LAKES, STREAMS.
For primary bibliographic entry see Field 06E.
W69-10043

ILLINOIS WATERWAY.
For primary bibliographic entry see Field 06E.
W69-10044

STATE AID IN FLOOD CONTROL; MUNICIPAL-FEDERAL FLOOD CONTROL PROJECTS.
For primary bibliographic entry see Field 06F.
W69-10048

WATER SERVICE DISTRICT.
For primary bibliographic entry see Field 06E.
W69-10049

BRIDGES.
For primary bibliographic entry see Field 06E.
W69-10056

WATER SUPPLY, DRAINAGE AND FLOOD CONTROL.
For primary bibliographic entry see Field 06E.
W69-10057

WATER DRAINAGE AND LEVEE DISTRICTS.
For primary bibliographic entry see Field 06E.
W69-10061

WATER DRAINAGE AND LEVEE DISTRICTS.
For primary bibliographic entry see Field 06E.
W69-10062

WATER DRAINAGE AND LEVEE DISTRICTS.
For primary bibliographic entry see Field 06E.
W69-10063

WATER DRAINAGE AND LEVEE DISTRICTS.
For primary bibliographic entry see Field 06E.
W69-10064

ARKANSAS IRRIGATION, DRAINAGE AND WATERSHED IMPROVEMENT DISTRICT ACT OF 1949.
For primary bibliographic entry see Field 06E.
W69-10065

IMPROVEMENT DISTRICTS OF RIVER WATER - DRAINAGE AND LEVEE DISTRICTS.
For primary bibliographic entry see Field 06E.
W69-10066

LEVEE AND DRAINAGE DISTRICTS.
For primary bibliographic entry see Field 06E.
W69-10076

FLOOD PLAIN INFORMATION, MISSISSIPPI RIVER AT NATCHEZ, MISSISSIPPI.
Corps of Engineers, Vicksburg, Miss.

Corps Eng Flood Plain Rep, June 1969. 37 p, 20 fig, 9 plate, 5 tab.

Descriptors: *Floods, *Flood damage, *Mississippi River, *Mississippi, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Natchez (Miss), Standard project flood, Intermediate regional flood.

Flooding of the Mississippi River at Natchez, Mississippi is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-10086

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN THE DISTRICT OF COLUMBIA.
Corps of Engineers, Baltimore, Md. North Atlantic Div.

Corps Eng Water Resources Develop Rep, Jan 1, 1969. 23 p, 1 fig, 1 plate, 7 photo, index.

Descriptors: *Water management (Applied), *District of Columbia, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U.S. Army Corps of Engineers projects (D.C.).

U.S. Army Corps of Engineers water resources development projects in the District of Columbia are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-10102

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN MARYLAND.
Corps of Engineers, Baltimore, Md. North Atlantic Div.

Corps Eng Water Resources Develop Rep, Jan 1, 1969. 80 p, 3 fig, 48 photo, 2 map, index.

Descriptors: *Water management (Applied), *Maryland, *Water resources development, Navigation, River basin development, Flood control, Multiple purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U.S. Army Corps of Engineers projects (Maryland).

U.S. Army Corps of Engineers water resources development projects in Maryland are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-10103

SHORT-RANGE FORECASTING OF LOWLAND-RIVER RUNOFF.
Gidrometeorologicheskii Institut, Leningrad (USSR).
For primary bibliographic entry see Field 02A.
W69-10146

DRAINS, CULVERTS, AND BRIDGES AS PART OF THE STATE HIGHWAY.

Ind Ann Stat sec 36-110 (1949).

Descriptors: *Indiana, *Drains, *Culverts, *Bridges, Legislation, Legal aspects, Contracts, Highways, Bridge construction.

All drains, culverts, and bridges on any state highway will be considered part of the state highway. All bridges having a span of over twenty feet may be let as a separate contract; the procedure is the same as for letting contracts for state highways. (Keith-Fla)
W69-10179

EMINENT DOMAIN.
Ind Ann Stat sec 36-303 (1949).

Descriptors: *Indiana, *Drainage, *Highways, *Eminent domain, Bridges, Culverts, Legislation, Land tenure, Right-of-way, Construction, Administrative agencies, Public lands.

In all cases of a highway constructed under the provisions of this act, the right of way therefor, or any required drainage courses, or approaches, or land necessary to build a bridge or culvert, shall be acquired by the county, either by donation by the owners of the land through which such highway shall pass or by agreement between such owner and the board of commissioners of such county, or through the exercise by such board of commissioners of the power of eminent domain, or through the public acquisition of such property as is necessary in the same manner as is now provided by law for the establishment, opening and widening of public highways, and in any event the entire cost of such right of way shall be paid for by the county. (Heckerling-Fla)
W69-10185

ERECTION AND INSPECTION OF DAMS.
NH Rev Stat Ann secs 482:3-482:15 (1968).

Descriptors: *New Hampshire, *Dam construct
*Administrative agencies, *Dams, Legislati
Water policy, Legal aspects, Financing, Regu
tion, Jurisdiction, Dam design, Damsites, Admin
tration, Permits, Water rights, Administrati
costs, Decision making, Standards, Wa
resources development, Inspection.
Identifiers: Penalties (Civil).

Construction must not begin on any dam until t
days have elapsed after the filing of a statem
showing the height of the proposed dam and its
cation with the Water Resources Board. The Boa
may require the owner or applicant to produ
plans and specifications for the dam which must
approved by the board if, initially, there is conce
that an improperly constructed dam would be
menace to public safety. The Board may design
an inspector to supervise the construction und
such plans. The Board has authority to issue ord
requiring owners or contractors of such dams
comply with the approved plans and specificatio
The Board from time to time causes all dams in t
state to be inspected to protect public safety a
may require such repairs as are deemed necessa
Penalties, injunctions, and appellate relief a
procedures under which the provisions of t
chapter are carried out. Expenses for examini
plans and inspections of dams are paid by the da
owners and, though received by the state, are a
plied to the appropriation available for use by t
Board. (Johnson-Fla)
W69-10223

CONNECTICUT RIVER FLOOD CONTRO COMPACT.

Vt Stat Ann Tit 10, secs 801-810 (1958),
amended, (Supp 1968).

Descriptors: *Vermont, *Flood control, *Wa
resources development, *Interstate compac
State governments, Economic impact, Economi
Recreation, Social impact, Planning, Investig
tions, Cost analysis, Decision making, Leg
aspects, Governments, Government financ
Federal government, Legislation, Water law, A
ministrative agencies, Political aspects, Wa
rights, Dams, Reservoirs, Multiple purpose p
jects, Water distribution (Applied), Irrigation.

The federal government's flood control act of 19
which provided for construction of dams for flo
control, irrigation, hydroelectric power, a
recreation removes from the tax rolls of lo
governments such property as is acquired for t
above purpose. The compact's signatories, Co
necticut, Massachusetts, New Hampshire, and Ve
mont, recognize that it is in their general welfare
join together to promote not only cooperation wi
the federal government, but also to protect th
own local interests in such affairs. The Connecti
River Valley Flood Control Commission
established with the general powers necessary f
the making of studies aimed at the development
a comprehensive plan for flood control and utiliz
tion of water resources. Construction sights fo
number of dams are agreed to by the compa
members. Connecticut and Massachusetts agree
compensate other signatories for economic los
and damages occasioned by such dams or res
voirs as determined by the commission. An arbitr
tion procedure is prescribed in the event that t
commissioners cannot agree on the amount
compensation. The compact, in order to becom
effective, must be approved by each signatory st
and the Congress of the United States. (Johnso
Fla)
W69-10224

DRAINAGE OF LOW LANDS.
Vt Stat Ann Tit 10, secs 501 thru 515 (1958),
amended, (Supp 1968).

criptors: *Vermont, *Drainage, *Administra- agencies, *Jurisdiction, Surface drainage, ches, Drainage programs, Drainage systems, d management, Water law, Legal aspects, islation, Local governments, Farm manage- t, Drainage practices, Adjudication procedure, ial aspects, Political aspects, Damages, Costs, tercourses (Legal).

ners of low or swamp lands may drain them for poses of cultivation, but when a dispute ween landowners over the opening of a ditch or er course arises, the selectmen of the town must notified in writing in order that they may con- t an investigation. At the hearing on the dispute ectmen may take such action as deemed neces- , including apportioning of costs of such ditch ong the parties. When owners refuse to open ches across their property and same appears essary and in the public interests, the selectmen y allow parties who would be benefited by the h to open one across the land of such owners. nages may be claimed by the landowner ough whose land such ditch is constructed. Such nages will be paid by the parties benefited by the h. Cleaning and repairing of the ditches are the ponsibilities of the landowner. Appeal from isions of the selectmen may be made to the nty court; such court may accept or reject the ard or appoint a commission of three disin- ested freeholders who will examine the premises make recommendations to the court. (John- -Fla)
9-10225

BIN V W. H. HINMAN, INC. (STATE AINAGE EASEMENTS).
A2d 708-712 (Me 1969).

criptors: *Maine, *Drainage, *Easements, minent domain, Condemnation, Legal aspects, ht-of-way, Judicial decisions, Drainage prac- s, Local governments, Highways, Public efits, Administrative agencies.
ntifiers: *Drainage easements.

intiff brought an action for trespass because de- dant, road contractor, entered upon his proper- vithout permission, dug a trench, and laid a pipe rein. The defendant was justified in such action y if the State Highway Commission had lawfully en a drainage easement over the plaintiff's pro- ty for highway purposes. The issue was whether agreement between the municipality and the e Highway Commission was invalid. The agree- nt was to the effect that this property would ert to municipal control. The court held that the e may validly exercise the power of eminent ain if the property was taken for a public pur- e whether or not it is in effect being done for ther level of government. Defendant's motion summary judgment was granted and the taking ne drainage easement approved. (Johnson-Fla)
9-10226

CKS.

a Code Ann secs 384.1-384.4 (1949), as nded, (Supp 1969).

criptors: *Docks, *Construction, *City ning, *Iowa, Condemnation, Taxes, Tax rate, igable rivers, Channels, Wharves, Railroads, lic utilities, Local governments, Legislation, tracts, Cities, Administrative agencies, Ease- its, Planning.

es on navigable waterways may establish a de- ment of public docks. This board, created to ervise the department, shall prepare a general of harbor improvement. The board is em- ered to purchase or condemn needed property has exclusive control over municipal wharf perty. It has authority over those streets neces- to further the general plan and control over harbor and water front as is not inconsistent the laws of the United States. The board may e ordinances for the collection of reasonable fees for the use of such municipal facilities. Construction contracts must be let by competitive bids. All costs of construction will be met by special taxes or bonds approved by the voters. All state regulation pertaining to the operation of railroads or public utilities shall apply to this department. (Darragh-Fla)
W69-10232

LEVEE AND DRAINAGE DISTRICTS.
Iowa Code Ann, secs 455.56, 455.70 to 455.72, as amended, (Supp 1969).

Descriptors: *Iowa, *Drainage districts, *Drainage systems, *Assessments, Legislation, Administration, Administrative agencies, Regulation, Ditches, Drainage programs, Classification, Cost allocation, Cost-benefit analysis, Cost sharing, Benefits, Legal aspects, Drains.

When adopted, a classification of land for drainage purposes remains the basis for future assessments unless revised by reclassification procedures. Classifications are apportioned when parcels are divided, which may be by agreement of the parties, by an appointed commission, or by the county auditor. After establishment of a drainage district, any land owner who was assessed but who is not directly on the ditch, drain, or watercourse, who desires to connect across another's land, but who cannot agree on terms and conditions for connection, may petition for a subdistrict under proceedings established for original districts. Such connecting drain or ditch is presumed to be desirable as if a part of the original improvement and becomes a part of that improvement under the board's control. If assessments are inequitable because there has been a change in character of lands or because improvements or extensions have become necessary, the board may order a reclassification of all or part of the lands. (Douberley-Fla)
W69-10233

REGIONAL WATER DISTRIBUTION DISTRICT ACT.
Ark Stat Ann secs 21-1401 thru 21-1415 (1968).

Descriptors: *Arkansas, *Water districts, *Reservoir storage, *Water distribution (Applied), Legislation, Administration, Administrative agencies, Dams, Reservoirs, Retention reservoirs, Multiple-purpose reservoirs, Water storage, Water supply, Water purification, Retention, Water management (Applied), Distribution, Water contracts, Water rights, Water conveyance, Water delivery, Water utilization, Water policy, Regulation.

Public, nonprofit regional water districts may be organized to acquire and store water in reservoirs behind multi-purpose government dams, to purify and process water, and to distribute and transport such water to users. When a dam is authorized for construction, 100 or more voters owning land may petition the circuit court to establish a water district. The Soil and Water Conservation Commission investigates the proposal and files a report of its findings with the court. After a hearing, the circuit court orders the establishment of the district. The district is administered by a board of directors composed of three voters elected from each county in the district. The district is vested with corporate powers, and it may acquire title to stored water, transport and sell such water, provide necessary facilities, and aid customers in preparing facilities for water use. The district may fix and collect fees for services and has the power of eminent domain. The district is tax exempt, as is interest on all instruments of indebtedness. (Douberley-Fla)
W69 10234

WHITE RIVER NAVIGATION DISTRICT COMMISSION.
Ark Stat Ann secs 21-1601 thru 21-1611 (1968).

Descriptors: *Arkansas, *Rivers and Harbors Act, *Navigation, *Water resources development, Rivers, Administration, Administrative agencies, Legislation, Navigable rivers, Tributaries, Non-consumptive use, Riparian rights, Federal government, State governments, Interagency cooperation, Financing, Assessments, Costs, Cost sharing, Condemnation.
Identifiers: River navigation districts, Federal-state cooperation.

The White River Navigation District Commission cooperates with the Army and federal agencies in the development of the White River. The Commission provides necessary lands, easements, and rights of way, holds the United States free from damages resulting from River and Harbor Act projects, and shares costs of projects when necessary. The Commission consists of five commissioners appointed by the governor from counties adjacent to the river. Provisions are made for terms, removal, vacancies, and expenses of such commissioners; time and place of meetings; and designation of a chairman. The Commission has corporate powers, may operate and construct necessary facilities, and may raise funds by charging fees for terminal use or by assessing benefits to riparian owners for re-establishment of navigation. The Commission may acquire property by purchase or by condemnation and may borrow or issue bonds for financing. (Douberley-Fla)
W69-10235

ARKANSAS WATERWAYS COMMISSION.

Ark Stat Ann secs 21-1701 thru 21-1703 (1968).

Descriptors: *Arkansas, *Navigable waters, *Transportation, *Water management (Applied), Channels, Inland waterways, Stream improvement, Administration, Administrative agencies, Legislation, Streams, Navigable rivers, Harbors, Recreation, Non-consumptive use, Water policy, Water utilization, Regulation, Water resources development.

The Arkansas Waterways Commission is composed of seven members appointed by the governor for seven year terms. At least one member is from each of the state's five stream basin areas. Provisions are made for recommendations for appointment, filling of vacancies, and compensation. The Commission: (1) studies and coordinates efforts to develop navigable streams; (2) encourages and coordinates development of river port and harbor facilities; (3) encourages and coordinates water recreation and recommends the establishment of recreation areas and rules and regulations; (4) represents the state in matters concerning fees for water transportation services; and (5) receives grants and donations for river transportation development. (Douberley-Fla)
W69-10236

WINYAH BAY TO SOUTH, ASHLEY RIVER AND SHIPYARD RIVER.
SC Code Ann secs 70-251 thru 70-268 (1962), as amended, (Supp 1968).

Descriptors: *South Carolina, *Water resources development, *Navigation, *Inland waterways, Legislation, Administrative agencies, Legal aspects, Water utilization, Oysters, Ownership of beds, Beds under water, Boundaries (Property), Riparian rights, Condemnation, Easements, Condemnation value, Jurisdiction, State jurisdiction, Water rights, United States, Rivers and Harbors Act, Land use, Damages.

The Governor and the Secretary of State may issue grants of perpetual right and easement to lands, including submerged lands, necessary to the United States for completion of the intracoastal waterway as approved by the River and Harbor Act of 1937. Lands raised by construction and maintenance of such intracoastal water are similarly granted to the federal government. Lands in private hands necessary for such project are secured for the state by

the State Development Board, whether by purchase, donation, or otherwise, through agreement with the owner when possible. When agreement is not possible, procedures similar to those employed in condemnation of lands for highway purposes are employed. The United States may condemn such property if it desires. The state retains jurisdiction over all properties granted for this project in all civil and criminal actions over which it would otherwise have jurisdiction. In the event lands taken under this chapter have been leased by the state Wildlife Resources Commission for cultivation of oysters, suitable replacement will be made and damages to beds outside land so taken which are caused by the project will be reimbursed by the persons causing same. (Johnson-Florida)
W69-10238

DAVIS V CAHOON (DIVERSION OF NATURAL FLOW BY LOWER LANDOWNER PROHIBITED).
168 SE2d 70-74 (Ct App NC 1969).

Descriptors: *North Carolina, *Natural flow doctrine, *Diversion, *Drainage systems, Surface waters, Canals, Floodgates, Flood damage, Judicial decisions, Obstruction to flow, Relative rights, Pumping, Land tenure, Easements, Legal aspects, Tidal waters, Riparian rights, Water rights, Alteration of flow.
Identifiers: *Subservient lower estate, Upper land, Lower land.

Plaintiffs and defendants owned tracts of land which, along with other tracts, shared the West One Canal for purposes of draining their lands into the tidal waters of Juniper Bay, a natural water body. Flood gates operated automatically to close the canal whenever tidewaters in the bay became high enough to run back into the canal and flood the lands. Plaintiffs alleged that defendants changed the drainage system by placing dikes and canals on their land to concentrate drainage and by using pumps to convey the excess water in large amounts into the West One Canal. Plaintiffs alleged that when the floodgates were shut, the pumping caused flooding of plaintiffs' land, and when they were open the force of the pumped water into the canal created a dam obstructing the natural flow. On appeal from an involuntary nonsuit, the court of appeals of North Carolina held that an easement for reasonable natural drainage existed in favor of upper landowners. The court noted that although defendants could accelerate natural flow, they could not divert it. The question of acceleration or diversion was held to be for the jury, and the court granted a new trial on that ground. (Harris-Florida)
W69-10239

BLOOM V WATER RESOURCES COMMISSION (RELATIVE RIGHTS OF OWNERS OF ADJACENT UPLANDS).

254 A2d 884-889 (Conn 1969).

Descriptors: *Connecticut, *Relative rights, *Riparian rights, *Permits, Legal aspects, Marinas, Navigable rivers, Administrative agencies, Regulation, High water mark, Low water mark, Boundaries (Property), Channels, Navigation, Water rights, Competing uses, Dredging, Construction, Judicial decisions, Riparian land.
Identifiers: *Littoral rights.

Plaintiffs appealed from the state water resources commission's granting of a permit to the defendant, an adjacent landowner, which authorized the construction of a marina and the dredging of a channel in front of defendant's property. Plaintiffs use their upland in connection with their oystering operation. Plaintiffs' complaint was based on the fact that the defendant's marina would prevent ingress and egress of plaintiffs' oyster boats except from one side. The court found that defendant's ownership of the adjoining upland gave him the exclusive right to dig channels and build wharves from his land to reach deep water, so long as he did not interfere with free navigation. The court held in affirming the decision of the superior court that the issuance of a permit to the defendant was not an adjudicative action as to the plaintiffs such as to entitle them, as a requirement of due process, to a hearing. The permit issued the defendant gave him only those rights to which he would have been entitled at common law, and the plaintiffs' rights remained unchanged. (Keith-Florida)
W69-10240

SKAFF V SIOUX CITY (UNREASONABLE DELAY IN CONDEMNATION PROCEEDINGS).

168 NW 2d 789-794 (Iowa 1969).

Descriptors: *Iowa, *Condemnation, *Cities, *Damages, Eminent domain, Flood control, Access routes, Relocation, Land tenure, Relative rights, Remedies, Judicial decisions, Condemnation value, Legal aspects, Compensation, Flood protection, Projects, Project planning, Financing.
Identifiers: Urban renewal, Unreasonable delay.

Plaintiffs owned rental property near the Floyd River, a perennial source of flood damage to the city. Defendant city determined that it was necessary to take plaintiffs' property in order to relocate the river pursuant to plans of the Floyd Flood Control Project. In 1960, the defendant notified plaintiffs that their property was within the flood control project, and subsequently negotiations were begun for acquisition of the property. Plaintiffs lost access to their property in 1962. However, defendant did not take plaintiffs' property until 1965 so that it could gain financial advantage by using urban renewal funds. In a suit for damages caused by unreasonable delay in perfecting its condemnation of plaintiffs' property, the trial court found that the city showed bad faith in protracting the proceedings which resulted in a substantial loss of rental profits to plaintiffs. On appeal by the city, the Supreme Court of Iowa affirmed the trial court's finding that the delay in perfection of condemnation occasioned by the shift from the flood control project to urban renewal was unreasonable. (Harris-Florida)
W69-10241

DISTRICTS TO MAINTAIN AND OPERATE FLOOD CONTROL WORKS.

Ky Rev Stat Ann secs 104.450-104.680 (1968), as amended, (Supp 1968).

Descriptors: *Kentucky, *Administrative agencies, *Flood control, Levees, Legislation, Taxes, Tax rate, Assessments, Gaging stations, Boundaries (Property), Contracts, Operating costs, Operation and maintenance, Contours, Adjudication procedure, State governments, Administration, Regulation, Costs, Leadership, Flood protection, Surveys, Structures.
Identifiers: *Flood control districts.

The Commission of Conservation of the Commonwealth of Kentucky may establish flood control districts for the purpose of maintaining and operating flood control works. Procedures for the establishment of such districts and their boundaries are set forth. Provisions are also made for the following: (1) the certification of the establishment of districts; (2) the appointment of a board of directors; (3) court action opposing the creation of a district; (4) officers and employees of the board of directors and their duties; (5) contracts for work, materials or supplies; (6) the maintenance of stream and rain gauges and scientific surveys; (7) the levy and collection of a tax for each district and the assessment of the valuation of property within the district; and (8) depreciation, operation and maintenance funds. For purposes of this act, 'flood control works' is defined. (Marsee-Florida)
W69-10243

DISTRICTS TO MAINTAIN AND OPERA FLOOD CONTROL WORKS.

Ky Rev Stat Ann secs 104.450-104.560 (1963), amended, (Supp 1968).

Descriptors: *Kentucky, *Administrative agenci *Flood control, Legislation, Boundaries (Prop ty), Levees, Contours, Adjudication procedur State governments, Administration, Regulatio Leadership.
Identifiers: *Flood control districts.

The Commissioner of Conservation of the Co monwealth of Kentucky is vested with the jurisd tion and power to establish flood control distri for the purpose of maintaining and operating flo control works. The boundary line of such distri shall be determined with reference to the floodw or levee and the contour line on the line back such floodwall or levee. A petition signed by seve ty percent of the freeholders within a proposed d trict shall be filed with the Commissioner of Co servation before such district may be establishe and such petition shall be governed by the pro sions herein. Property owners opposing the cre tion of a proposed district may do so in the circu court wherein the proposed district is to be locat and shall conform to the procedure here set fort The Commissioner of Conservation shall issue certificate of establishment of each district, a such certificate shall be final and binding upon t real property in the district. For purposes of this a 'flood control works' is defined. (Marsee-Florida W69-10244

DISTRICTS TO MAINTAIN AND OPERAT FLOOD CONTROL WORKS.

Ky Rev Stat Ann secs 104.570-104.680 (1963), amended, (Supp 1968).

Descriptors: *Kentucky, *Administrative agencie *Flood control, Legislation, Administration, Taxe Tax rates, Assessments, Gaging stations, Operati costs, Costs, Contracts, Operation and mai tenance, Adjudication procedure, Regulatio Leadership, State governments.
Identifiers: *Flood control districts.

The Commissioner of Conservation shall designat in the certificate of establishment of a flood contr district, the place where the office of the distri shall be located. There shall be appointed a boa of directors for each district the business of whic shall be conducted as here set forth. The Board charged with the following: (1) to elect a presider secretary and treasurer; (2) to govern the floo control district; (3) to adopt all necessary regul tions for carrying into effect the objects for whic the district was formed; (4) to recover by civil a tions from any persons violating such rules an regulations; (5) to enforce by mandamus a authorized rules and regulations; (6) to have an a nual audit made; (7) to employ an attorney, an e gineer, and other employees; (8) to contract f work, materials and supplies; (9) to establish a maintain stream and rain gauges and surveys nece sary for the purpose of the district; (10) to levy annual tax on the property within the district; an (11) to maintain depreciation, operation and mai tenance funds. Persons willfully failing to comp with regulations of the Board will be liable f damages. (Marsee-Florida)
W69-10245

POWER TO ACQUIRE PIERS AND BEACHES.

Ill Ann Stat ch 24, sec 11-93-1 (Smith-Hurd 1962

Descriptors: *Illinois, *Eminent domain, *Recre tion facilities, *Cities, Legislation, Beaches, Pier Navigable waters, Public benefits, Land tenur Land use, Legal aspects.

The corporate authorities of each municipality ma acquire by eminent domain private lands borderin

upon public or navigable waters, which are useful or desirable for bathing beaches and recreation piers. (Heckerling-Florida)
W69-10248

STATE AID IN FLOOD CONTROL; MUNICIPAL-FEDERAL FLOOD CONTROL PROJECTS.
Ill Ann Stat ch 24, secs 11-115-1, 11-115.1-1 (Smith-Hurd 1962), as amended, (Supp 1969).

Descriptors: *Illinois, *Federal government, *Contracts, *Flood control, Cities, Legislation, Administrative agencies, Regulation, Bridges, Construction, Pollution abatement, Flood protection, Easements, Right-of-way, Damages, Projects, Operation and maintenance, Construction costs, United States, Flood routing, Waste dumps, Landfills.

Whenever the state appropriates money for the construction of works to protect against floods, the authorities of any municipality benefited may contract with the state to take over and maintain the works. Any city may contract with the United States that with reference to any flood control project constructed by the United States it will: (1) provide lands, easements, and rights-of-way without cost, (2) contribute part of the construction costs, (3) hold and save the United States free and harmless from claims of damages resulting from such construction, (4) maintain and operate all works after completion, (5) establish and enforce flood channel limits for protection of any flood channel, (6) prevent dumping waste material or the creation of fills within any flood channel limits, and (7) regulate the construction of bridges or other structures crossing any waterway. (Heckerling-Florida)
W69-10250

LOCATING SOURCE OF WATER SUPPLY OUTSIDE OF MUNICIPALITIES.
Ill Ann Stat ch 24, secs 11-138-1, 11-138-2 (Smith-Hurd 1962).

Descriptors: *Illinois, *Eminent domain, *Water supply, *Cities, Legislation, Damages, State governments, Reservoirs, Navigable waters, Compensation, Operation and maintenance, Construction, Pollution abatement, Pipelines.

Any water company organized under the laws of this state may construct, maintain, and operate, beyond the corporate limits of a municipality, lines of water-pipe across or under any waters of this state, subject to certain specified conditions. Whenever it is necessary for the construction, maintenance, and operation of lines of water-pipe or reservoirs, or for the protection of reservoirs, submerged land, and the source of supply from contamination, pollution, or damage from any cause, to take or damage private property adjacent to these improvements, that property may be taken or damaged, and the compensation therefor may be ascertained and paid in the manner which may be provided by law for the exercise of the right of eminent domain. (Heckerling-Florida)
W69-10251

4B. Groundwater Management

EVALUATION AND CONTROL OF CORROSION AND ENCRUSTATION IN TUBE WELLS OF THE INDUS PLAINS, WEST PAKISTAN,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 08G.
W69-09910

CONJUNCTIVE USE OF GROUND AND SURFACE WATERS,
California State Dept. of Water Resources, Los Angeles.
For primary bibliographic entry see Field 06A.
W69-10012

IDENTIFICATION OF DISTRIBUTED UNCONFINED AQUIFER PARAMETERS,
California Univ., Los Angeles.
For primary bibliographic entry see Field 02F.
W69-10019

ARTESIAN WELLS.
For primary bibliographic entry see Field 06E.
W69-10067

LAND SUBSIDENCE ALONG THE DELTA-MENDOTA CANAL, CALIFORNIA,
Bureau of Reclamation, Sacramento, Calif.
N. P. Prokopovich, and D. J. Herbert.
Amer Water Works Ass, Vol 60, No 8, p 915-920, Aug 1968. 6 p, 11 fig.

Descriptors: *Subsidence, *Overdraft, *California, *Canals, Drawdown, Water levels, Irrigation water, Damages, Flooding, Submergence.
Identifiers: Delta-Mendota Canal (Calif).

Land subsidence caused by groundwater overdraft is changing the gradient of the Delta-Mendota Canal, California. Bridges are submerged and the canal lining is 1-6 ft lower than when it was installed in some locations. Replacement of well water by canal water for irrigation has ended the overdraft, but continued lag subsidence may be expected to amount to as much as 2 ft in the next 25 yrs. (Knapp-USGS)
W69-10135

GROUND WATER CONSERVATION.

Ind Ann Stat secs 27-1301 thru 27-1316 (1960).

Descriptors: *Indiana, *Groundwater, *Water conservation, *Water pollution, Legislation, Legal aspects, Administrative agencies, Bodies of water, Lakes, Groundwater basins, Water loss, Public health, Regulation, Surveys, Federal government, Permits, Public utilities, Potable water, Streams, Aquifers, Water supply, Beneficial use, Injection, Subsurface waters, Withdrawal, Groundwater.
Identifiers: *Restricted use.

The term 'ground water' is defined to mean all water filling the natural openings under the earth's surface. The term 'waste' is defined to include ground water loss, pollution, or use which is less than the fullest beneficial use. It is the policy of the state to conserve and protect the ground water resources and to provide regulations for its most beneficial use. The department of conservation may designate certain areas of the state where the withdrawal of ground waters exceeds or threatens to exceed its natural replenishment as restricted use areas. When an area is so designated, any entity other than a public utility must obtain a permit to withdraw groundwater in excess of 100,000 gallons per day more than it was using when the area was restricted. Specific methods for enforcing the permit requirement are provided. Entities commiting waste of ground water in restricted use areas may be required to return such water to the ground. A permit must be obtained to introduce potable ground water into any underground formations which contain non-potable water. (Keith-Florida)
W69-10298

4C. Effects of Water of Man's Non-Water Activities

DRAINAGE OF ROADBED.
For primary bibliographic entry see Field 06E.
W69-09945

RESERVOIR LOCATION FOR URBAN RECREATION,
Purdue Univ., West Lafayette, Ind.
W. L. Miller, and R. L. Kilmer.
Proc, Fourth Amer Water Resources Conf, N Y, p 669-678, Nov 1968. 10 p, 1 fig, 3 tab, 9 ref.

Descriptors: *Reservoir sites, *Locating, *Recreation, Urbanization linear programming, Optimization, Size, Water resources development, Resources allocation, Population, Cost analysis, Indiana, Regional analysis.

The effect population has upon the optimum size, number and location of water reservoirs was examined. These reservoirs were used primarily for recreational facilities. Two water reservoir systems were compared: (1) the optimum minimum cost reservoir system which provided adequate facilities to satisfy the fixed quantity of recreation demanded, and (2) the restricted minimum cost reservoir system which also adequately provided for the fixed demand, but included reservoirs already constructed in the system at their actual size and in their actual location. A linear programming model was developed and used to minimize the total system cost while still providing adequate facilities for the fixed quantity demanded in the region. The Indiana reservoir system with eleven already constructed reservoirs was taken as an example. The application of the model showed that the total system cost increased by over five million dollars when the optimum solution was modified by forcing eleven reservoirs into the solution. The optimum system showed no obvious increase in the number of reservoirs located close to the urban areas. However, reservoirs near urban areas were larger indicating more urban use of nearby reservoirs in the optimum system. (Thiuri-Cornell)
W69-10022

UNITED STATES V 930.65 ACRES OF LAND IN JEFFERSON COUNTY (VALUATION OF LAND WITHOUT WATER SUPPLY).
For primary bibliographic entry see Field 06E.
W69-10058

SELECTED URBAN STORM WATER RUNOFF ABSTRACTS.
Franklin Inst. Research Labs., Philadelphia, Pa. Science Information Services.

Fed Water Pollut Contr Admin Res Ser WP-20-21, June 1969. 109 p, 573 ref, 3 index. FWPCA Contract No 14-12-467. Published in coop with WRSIC. Available from Clearinghouse as PB 185-314, at $3.00 in paper copy and 65 cents in microfiche.

Descriptors: *Abstracts, *Bibliographies, *Storm runoff, *Urbanization, Instrumentation, Flood control, Sewers, Hydraulics, Water quality, Water law, Legislation, Water pollution treatment, Rainfall-runoff relationship, Storm drains, Water pollution sources, Water pollution control.
Identifiers: *Urban hydrology.

Selected urban storm water runoff abstracts is a compilation of abstracts summarizing articles from a variety of technical publications, covering the subjects of urban runoff, storm water discharge, storm sewers, and combined sewers, together constituting 'the problem of urban drainage'. The present compilation represents as complete a bibliographic record as possible of storm water articles, up to 1968. The 187 abstracts from the 1966 edition were indexed, but not otherwise edited or reevaluated. For convenience, the abstracts are classed in 11 sub-topic categories, and arranged by abstract number within each category. Since most of the papers fit into more than one category, the cumulative subject index at the end of the volume provides the necessary access to individual concepts. Each item includes a bibliographic citation, an abstract, and a set of indexing descriptors. Copies of the articles abstracted in most cases can be obtained from research libraries covering water pollution or public health engineering literature. Some are generally available and may be inspected at the offices of the Storm and Combined Sewer Pollution Control Branch, Div of Applied Science and Technology, Federal Water Pollution Control Administration (FWPCA), Department of the Interior, Washington, D.C., 20242. None of the articles are available for distribution by FWPCA. (Knapp-USGS)
W69-10085

FLOODS OF JULY 2, 1968, IN JACKSON, MISSISSIPPI,
Geological Survey, Jackson, Miss.
For primary bibliographic entry see Field 02E.
W69-10101

BRADSHAW V STATE HIGHWAY COMM'R (REQUIREMENT OF LANDOWNERS TO MITIGATE CONDEMNATION DAMAGES).

168 SW2d 129-131 (1969).

Descriptors: *Virginia, *Condemnation value, *Eminent domain, *Road construction, Artificial watercourses, Damages, Market value, Judicial decisions, Access routes, Land tenure, Appeals, Property values, Legal aspects, Condemnation.
Identifiers: Mitigation of damages.

The state highway commissioner condemned, among other things, a pond on landowners' property for highway construction purposes. Only a portion of the man-made pond had to be taken. The issue was whether evidence concerning the cost of restoring the pond to its original size was admissible. The landowners objected to its admissibility on the ground that they could not be required to enter into a doubtful and speculative enterprise to mitigate damages. The Supreme Court of Appeals of Virginia held this evidence admissible as an aid to the commissioners in fixing the market value of the property before and after taking. The court distinguished a case relied upon by the landowners when the owner of oyster beds was not required to make a highly speculative replant of oysters in order to minimize damages in a condemnation proceeding. (Harris-Fla)
W69-10237

STREAM CAVING AND ROAD CONSTRUCTION.

Ind Ann Stat secs 36-222 thru 36-224 (1949).

Descriptors: *Indiana, *Bank erosion, *Road construction, *Boundaries (Property), Legislation, Legal aspects, Roads, Damages, Watercourses (Legal), Banks, Construction, Land tenure, Land use, Compensation, Assessments.
Identifiers: *Fences, *Stream caving.

When any public highway which passes along the bank of any watercourse becomes unsafe because the bank has washed away or fallen in, the road supervisor shall give the owner of the land over which the highway passes notice to move his fence back from the bank of the watercourse so that a new road may be constructed. If the owner fails to remove his fence, the supervisor may have it done. If any building stands so near the watercourse that space is not left for the new road, the supervisor may open the road on the side of the building away from the watercourse. If the owner of the affected property files a claim for damages within a specified time, construction cannot begin until he receives compensation. The method by which damages are to be assessed is set out. (Keith-Florida)
W69-10299

4D. Watershed Protection

SEDIMENTATION IN BROWNELL CREEK SUBWATERSHED NO. 1, NEBRASKA,
Geological Survey, Washington, D.C.
James C. Mundorff.
Geol Surv Water-Supply Pap 1798-C, p C1-C49, 1966. 49 p, 24 fig, 1 plate, 13 tab, 4 ref.

Descriptors: *Sedimentation, *Nebraska, *Reservoir silting, Sediment control, Silting, Desilting, Reservoirs, Sediment yield, Sediment load, Sediment transport, Silts, Sands, Streamflow, Precipitation (Atmospheric), Runoff.
Identifiers: *Sediment trap efficiency.

A sedimentation investigation in Brownell Creek subwatershed, Nebraska, was made as part of a nationwide investigation of the trap efficiency of detention reservoirs. The subwatershed is in southeastern Nebraska, has a drainage area of 495 acres, receives an average of 28.75 inches of precipitation annually, has a total relief of about 95 ft, and has a surface mantle composed mainly of loess and glacial till. Average annual runoff was 3.3 inches during 1955-59. Precipitation ranged from significantly below normal in 1955 and 1956 to appreciably above normal in 1957-59. Most of the sediment is silt and clay; generally, less than 10% of the suspended sediment is sand. Of the total sediment, all the sand and much of the silt and clay are trapped. Trap efficiency was between 90 and 95% during 1955-59. During 1955-59, total sediment discharge was about 400 tons, of which 135 tons was discharged during the period June 24-26, 1955. About 77% of the sediment was discharged during 7 outflow periods, each of which was less than 5 days in duration. (Knapp-USGS)
W69-09946

LEACHABILITY OF A WETTING-AGENT TREATMENT FOR WATER-RESISTANT SOILS,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 02G.
W69-09989

SOIL WETTABILITY: A NEGLECTED FACTOR IN WATERSHED MANAGEMENT,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 02G.
W69-09991

SEDIMENT--ITS CONSEQUENCES AND CONTROL,
Agricultural Research Service, Washington, D.C.; and Forest Service (USDA), Washington, D.C.
For primary bibliographic entry see Field 02J.
W69-10003

PUBLIC WATERSHED ASSOCIATIONS.

Md Ann Code art 25, Secs 169-218, 200A (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Watershed management, *Water management (Applied), *Water conveyance, Obstruction to flow, Water utilization, Water control, Flood control, Ditches, Drainage systems, Water conservation, Water rights, Costs, Planning, Soil conservation, State government, Local governments, Federal government, Legal aspects, Legislation.

The boards of county commissioners, or county council, may establish public watershed associations. The purposes of the associations will be watershed protection, flood control, conservation, and effective water utilization. The powers and responsibilities of the associations and procedure for their establishment are set forth. Provision is also made for creating a board of watershed viewers to examine proposed improvement plans. The boards of directors of the watershed associations carry out the approved improvement construction plans and manage the improvement works upon completion. The watershed associations may acquire water rights, provided the rights of others to water use is not impaired. The statute sets forth criteria governing: construction of ditches, drains, and other improvements across the land of others; costs of bridge construction over improvements; and dissolution of the watershed associations. (Kelly-Fla)
W69-10028

PUBLIC WATERSHED ASSOCIATIONS.
Md Ann Code Art 25, secs 169-189 (1957).

Descriptors: *Maryland, *Watershed management, *Water management (Applied), *Water conveyance, Obstruction to flow, Water control, Flood control, Ditches, Drainage systems, Water conservation, Costs, Planning, Soil conservation, State governments, Local governments, Legal aspects, Legislation, Administrative agencies, Water utilization.

The boards of county commissioners in the county council of the several counties of Maryland have the power to establish public watershed associations in their respective counties for the purpose of constructing and managing improvements for watershed protection, flood prevention, recreation, soil conservation, drainage, and for conservation, utilization, and disposal of water. The associations, once established, are authorized to cooperate with local, county, state and federal agencies in their operations. Landowners may petition a board of county commissioners for establishment of a watershed association. The association shall be governed by a board of directors which is responsible for developing plans for improvements and filing these with the county commissioners. The county commissioners shall appoint a board of watershed viewers to examine the area to be improved and to engage engineers for surveys. (Kelly-Fla)
W69-10029

PUBLIC WATERSHED ASSOCIATIONS.
Md Ann Code Art 25, secs 190-209 (1957).

Descriptors: *Maryland, *Watershed management, *Water management (Applied), *Water conveyance, Water utilization, Water control, Drainage systems, Water conservation, Water rights, Costs, Planning, State governments, Local governments, Legal aspects, Legislation, Assessments, Cost-benefit analysis, Benefits, Maintenance, Operation+ maintenance, Damages, Construction, Construction costs.

The board of watershed viewers may adopt any existing works as a part of proposed watershed improvements. Costs of improvements can be proportionately assessed against owners of benefited land. The statute provides procedures for settling contested damages awards for appropriated property and gives the board of watershed viewers authority to acquire necessary rights-of-way through condemnation. Bonds may be issued to finance construction of improvements. The board of directors for the public watershed association shall carry out the plan of watershed improvement, may employ laborers, and may purchase materials for construction. The board of directors is responsible for maintaining the improvements made and may levy taxes against benefited property for operation costs. (Kelly-Fla)
W69-10030

PUBLIC WATERSHED ASSOCIATIONS.
Md Ann Code Art 25, secs 210-218 (1957).

Descriptors: *Maryland, *Watershed management, *Water management (Applied), *Water conveyance, Water utilization, Water control, Flood control, Ditches, Drainage systems, Water rights, Costs, Planning, State governments, Local governments, Legal aspects, Legislation, Bridges, Highways, Construction costs.

The board of directors of any public watershed association may acquire water rights under existing law and may carry out improvement works for storage, utilization and distribution of water. The board is authorized to charge for water use, and to use any proceeds as payment for water rights and for management of the improvement works. The board is prohibited from interfering with the legal water rights of others. Any person taxed for a main ditch or drain which does not pass through or under his land may open a ditch through intervening land to such main ditch with consent of the owner of the intervening land. Obstruction of any ditch, drain, or other improvement made pursuant to this subti-

tle is a misdemeanor. Where a ditch or other improvement intersects a highway at the location of a natural watercourse, the county highway authority must pay for needed bridges. At other intersections the watershed association must bear bridge construction expenses. The board may develop supplemental plans for watershed works. A majority of landowners in a public watershed association may petition for dissolution to the county commission. (Kelly-Fla)
W69-10031

FLOOD CONTROL.
For primary bibliographic entry see Field 06E.
W69-10072

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

CHEMISTRY OF N AND MN IN COX HOLLOW LAKE,
Florida Univ., Gainesville.
Patrick L. Brezonik, Joseph J. Delfino, and G. Fred Lee.
ASCE Proc, J Sanit Eng Div, Vol 95, No SA 5, p 929-940, Oct 1969. 12 p, 7 fig, 2 tab, 14 ref, 1 append.

Descriptors: *Water chemistry, *Lakes, *Aeration, Stratification, Mixing, Oxidation, Nitrification, Manganese, Sorption, Reservoirs, Water temperature, Water pollution treatment.
Identifiers: *Destratification.

Concentrations and forms of nitrogen and manganese species were determined in Cox Hollow Lake, Wisconsin, after the lake was destratified by artificial aeration. Destratification of this impoundment was accomplished within one month of aeration and dissolved oxygen appeared throughout the water column at the same time. Nitrogen (mainly Kjeldahl N) decreased in the Lake during destratification, apparently as a result of sedimentation. Nitrate and nitrite appeared in the water column soon after the initial appearance of oxygen in the bottom water but rates of nitrification were estimated to be low, 3 mg per liter to 40 mg per liter. Inorganic nitrogen remained low following destratification. Destratification was also effective in removing manganese from the hypolimnion; bottom concentrations decreased from about 2 mg Mn per liter to about 0.3 mg Mn per liter after one month of aeration. About 50% of the total Mn was particulate. After reoxygenation some of the particulate Mn was found to be oxidized Mn, but most particulate Mn was Mn (II), presumably sorbed onto inorganic or organic particles. (Knapp-USGS)
W69-09881

RADIOECOLOGICAL SURVEILLANCE OF THE WATERWAYS AROUND A NUCLEAR FUELS REPROCESSING PLANT,
New York State Dept. of Health, Albany. Div. of Laboratories and Research; State Univ. of New York, Albany. Dept. of Biological Sciences; and State Univ. Coll., Fredonia, N.Y.
For primary bibliographic entry see Field 05C.
W69-10080

WORKSHOP ON WATER RESOURCE PROBLEMS AND RESEARCH NEEDS RELATED TO AGRICULTURE IN THE COASTAL PLAINS OF NORTH CAROLINA.
North Carolina Water Resources Research Inst., Raleigh.
For primary bibliographic entry see Field 03F.
W69-10294

5B. Sources of Pollution

STOCHASTIC MODEL FOR BOD AND DO IN ESTUARIES,
Virginia Polytechnic Inst., Blacksburg, Va.
Stephen W. Custer, and Richard G. Krutchkoff.
ASCE, J Sanit Eng Div, Vol 95, No SA 5, p 865-886, Oct 1969. 22 p, 8 fig, 11 ref, 2 append.

Descriptors: *Oxygen demand, *Estuaries, *Statistical models, Biodegradation, Biochemical oxygen demand, Dissolved oxygen, Water pollution effects, Water pollution control, Stochastic processes, Path of pollutants, Dispersion, Mixing, Probability.
Identifiers: *Potomac Estuary, Stochastic models.

The BOD and DO of estuaries was studied by using a statistical model of the biodegradation of pollutants. Using the assumption that the degrading process in nature is descrete rather than continuous, a stochastic model is constructed for the process. Unlike the results previously obtained for streams the mean effects did not coincide with previously obtained deterministic results. The mean effect and the fluctuations about this effect were compared with data from the Potomac estuary. The comparison is remarkably good, and strongly indicates the validity of the stochastic model. (Knapp-USGS)
W69-09879

MONTE CARLO SIMULATION OF WASTE DISCHARGE,
Wisconsin Univ., Madison.
Paul M. Berthouex, and Linfield C. Brown.
ASCE, J Sanit Eng Div, Vol 95, No SA 5, p 887-906, Oct 1969. 20 p, 4 tab, 12 fig, 16 ref, 2 append.

Descriptors: *Waste disposal, *Industrial wastes, *Water pollution control, *Simulation analysis, *Statistical models, Monte Carlo method, Computer models, Sewage treatment, Systems analysis, Optimization.
Identifiers: Waste discharge models.

The concepts of Monte Carlo simulation, in conjunction with relevent concepts from probability and statistics, are presented by illustrating their application to an industrial waste peak load smoothing problem. A tanning operation consisting of 8 batch processes and 2 continuous flow processes, is simulated. The formulation of all input data and assumptions is described in detail and the logic involved in programming the simulation is explained. The simulator was used to examine the possibility of smoothing peak loads, in terms of both flow and organic load, by altering the schedule of waste liquors from the various batch tanning processes. Several typical and important questions can be answered using the concepts. The basic concepts are presented in simple and general terms to facilitate and encourage the use of simulation in other industrial waste problem situations. (Knapp-USGS)
W69-09880

DISTRIBUTION OF PESTICIDES IN SURFACE WATERS,
Virginia Polytechnic Inst., Blacksburg, Va.
Paul H. King, H. H. Yeh, Pierre S. Warren, and Clifford W. Randall.
J Amer Water Works Ass, Vol 61, No 9, p 483-486, Sept 1969. 4 p, 7 fig, 2 tab, 7 ref.

Descriptors: *Pesticide kinetics, *Pesticide removal, *Adsorption, Soils, Coals, Distribution patterns, Activated carbon, Clays, Algae, Water purification, Water quality, Water chemistry.
Identifiers: Pesticide sorption.

Several papers on pesticide distribution in water, pesticide sorption in soil, and pesticide removal technology are reviewed and summarized, and experimental data are presented on pesticide sorption by soils, algae, and activated carbon. The pesticides studied are lindane and parathion. Experimental results are shown by sorption isotherms. In general, high-clay soils adsorbed about twice as much pesticide as sandy soils. Algae sorbed about 10 times as much as soils. Coal adsorbed about 2 1/2 times as much as soil, and activated carbon adsorbed about 4 orders of magnitude more than soil. (Knapp-USGS)
W69-09884

INFLUENCE OF SEDIMENTS ON SOLUTE TRANSPORT,
Texas Univ., Austin.
Chia-Shun Shih, and Earnest F. Gloyna.
ASCE Proc, J Hydraul Div, Vol 95, No HY 4, Pap 6699 p 1347-1367, Jul 1969. 21 p, 15 fig, 7 tab, 10 ref, 2 append.

Descriptors: *Path of pollutants, *Radioactive wastes, *Solutes, *Mathematical models, *Tracers, Strontium radioisotopes, Ion exchange, Adsorption, Dispersion, Sediment transport, Computer programs.
Identifiers: Solute transport.

A mathematical model which describes the transport of radionuclides injected instantaneously in a stream is developed. Instantaneous release of dye and continuous release of Sr-85 respectively, are used to measure the dispersion and mass transfer coefficients. Aquaria and model river experiments are undertaken to determine various parameters which define the mechanism of sorption and desorption of radionuclides by sediments. Instantaneous injection of Sr-85 into the model river provides data for establishing the relationship between the analytical solution and a proposed mathematical model. FORTRAN programs are designed for the analyses of gamma spectra, dispersion coefficients and transport equations. The mass transfer coefficient is found to increase with increased velocity. High uptake of Sr-85 by sediments may be provided by increased temperature and the presence of an organic pollutant. An exponential relationship is established between the Sherwood's number and the Reynold's number for the model river. (Knapp-USGS)
W69-09891

MOVEMENT OF A SOLUTE IN THE POTOMAC RIVER ESTUARY AT WASHINGTON, D.C., AT LOW INFLOW CONDITIONS,
Geological Survey, Washington, D.C.
James F. Wilson, Jr., Ernest D. Cobb, and Nobuhiro Yotsukura.
Geol Surv Circ 529-B, 1969. 14 p, 12 fig, 2 tab, 3 ref.

Descriptors: *Path of pollutants, *Estuaries, *Tracers, *Dye releases, *Aerial photography, Solutes, Dispersion, Diffusion, Streamflow, Tides, Currents (Water).
Identifiers: *Potomac River.

The movement of a solute, as represented by a soluble fluorescent dye, was observed in the Potomac River estuary at Washington, D.C. The average net rate of downstream movement of the solute centroid was less than 0.6 mi/day. The movement of a solute is highly dependent on the nontidal inflow to the estuary. During the study, the average inflow was 900 cfs, avery low value, equaled or exceeded 98% of the time. Using a storage equation, the average movement of a solute was estimated for nontidal inflow of 3,100 and 6,500 cfs; these inflows are equaled or exceeded 75 and 50% of the time, respectively. Tidal action was fairly efficient in dispersing the solute longitudinally. The solute, which was dumped 1,000 ft upstream from the 14th Street Bridge, was observed as far upstream as Roosevelt Island. A transient longitudinal dispersion coefficient at the end of 150 hr was determined to be 210 sq ft per second. On the other hand, the lateral diffusion was a slow process and the lateral distribution of the solute was far from

uniform at the end of 6 1/2 days after the release. (Knapp-USGS)
W69-09914

WATER QUALITY OF MOUNTAIN WATERSHEDS,
Colorado State Univ., Fort Collins.
Samuel H. Kunkle, and James R. Meiman.
Colo State Univ Hydrol Pap No 21, June 1967. 53 p, 33 fig, 9 tab, 19 ref, append.

Descriptors: *Water quality, *Streamflow, *Aquatic bacteria, *Solutes, *Turbidity, Mountains, Irrigation, Grazing, Coliforms, Sampling, Surveys, Color, Data collections, Statistical methods.
Identifiers: Mountain streams.

Water quality was investigated from April 1964 to September 1965 on mountain watersheds 7,600-9,790 ft high in the Colorado Front Range to assess water quality characteristics at varying natural flow regimes under conditions of limited land use. A total of 604 samples were taken. The parameters measured were: flow; water temperature; pH; turbidity; suspended sediment; dissolved solids; and total, coliform, fecal streptococcus (FS), and fecal coliform (FC) bacteria. Bacteria concentrations were closely related to the physical parameters of the stream and were especially dependent on the flushing effect of high runoffs. The seasonal trends of all bacteria groups were similar: (1) low counts prevailed while the water as 0 deg C; (2) high counts appeared during rising and peak flows; (3) a short post-flush lull in counts took place as runoff receded in early July; (4) high counts were found again in July-August; and (5) counts declined in September. The FC, FS, and coliforms all clearly defined grazing-irrigation impact; the FC showed the highest sensitivity to such pollution. The coliforms rated slightly less, while the FS were the least sensitive. Minimum pH values occurred near the peak flow, with a total range of from 6.3 to 8.7. There was a 0.1 to 0.2 pH unit decrease per 1000 ft of elevation. Turbidity and suspended sediment were positively related to flow and to each other. No relations between dissolved solids and other physical or bacterial parameters were found. (Knapp-USGS)
W69-09943

OPTIMUM WATER QUALITY MANAGEMENT OF STREAM AND ESTUARINE SYSTEMS,
Manhattan Coll., Bronx, N.Y. Dept. of Civil Engineering.
Robert V. Thomann.
Proc, Fourth Amer Water Resources Conf, N Y, p 115-122, Nov 1968. 8 p, 4 fig, 3 ref.

Descriptors: *Dynamic programming, *Water quality control, *Waste treatment, *Stream improvement, *Estuaries, *Variability, Dissolved oxygen, Mathematical models, Delaware River, Fluctuation, Linear programming, Optimization.
Identifiers: Green River (Wash).

The use of dynamic water pollution control models instead of steady or quasi steady state models was discussed. Various steady state optimization schemes using linear or dynamic programming techniques could be employed to determine the 'best' combination of waste treatment that met a steady state dissolved oxygen (DO) objective. However, the analysis failed to recognize the dynamic nature of the environment. A study of response time for the Green River in Washington and the Delaware Estuary revealed that it took hours for the former and weeks for the latter to reach a specified control level, small streams responding more rapidly than large estuaries. Waste inputs were found to vary also. Analysis of the characteristics of waste load fluctuations for the City of Philadelphia indicated a degree of random behavior with tendencies for seasonal and weekly periodicities. A control model that incorporated the dynamic aspects of optimum water quality control systems was then developed. (Thiuri-Cornell)
W69-10024

SEWAGE DISPOSAL SYSTEMS ON ISLANDS.
For primary bibliographic entry see Field 06E.
W69-10034

WATER POLLUTION AND DISPOSAL OF WASTES.

NH Rev Stat Ann secs 149:1 thru 149:19 (1964), as amended, (Supp 1967).

Descriptors: *New Hampshire, *Regulation, *Water pollution, *Sewage, Legislation, Waste, Surface water, Ground water, Biochemical oxygen demand, Impaired water quality, Public health, Microenvironment, Non-consumptive use, Industrial wastes, Bacteria, Coliforms, Standards, Classification, Administrative agencies.
Identifiers: Penalties (Criminal).

The New Hampshire Water Pollution Commission is established. Its duties include the authority to issue orders and regulations for the protection of public health to provide procedures for enforcement, and to establish penalties to be exacted for violations thereof. Standards and procedures for classification of state surface waters are set forth. Authorization for the state to guarantee, unconditionally, the payment of all or any portion of the principle and interest on bonds and notes issued by any municipal government for the construction of sewage systems or other pollution control facilities is provided. Geographical areas are assigned water classifications. Such classifications are to be enforced by appropriate court action. Procedures for procuring general variance authorization are provided, with special provisions for seasonal and emergency variances. Appropriate penalties for violation of these provisions are set forth. (Moulder-Fla)
W69-10035

WATER POLLUTION AND DISPOSAL OF WASTES.

NH Rev Stat Ann secs 149:1 thru 149:3 (1964), as amended (Supp 1967).

Descriptors: *New Hampshire, *Sanitary engineering, *Public health, *Environmental engineering, Legislation, Regulation, Water pollution, Waste disposal, Surface waters, Wastes, Biochemical oxygen demand, Bacteria, Coliforms, Water pollution sources, Sewage treatment, Sewage bacteria, Dissolved oxygen, Oxygen requirements, Standards, Classification.

The New Hampshire Water Pollution Commission's primary duties are to police state water pollution and waste disposal. Surface waters are divided into the following classifications. Class A waters are of the highest quality and shall contain not more than fifty coliform bacteria per one hundred milliliters; no discharge of sewage waste into these waters is permissable. Class B waters are divided into two subclasses. B1 shall have no objectionable physical characteristics, shall be near saturation for dissolved oxygen, and shall contain not more than two hundred forty coliform bacteria per one hundred milliliters. These waters are acceptable for bathing and recreation. B2 waters contain not more than one thousand coliform bacteria per one hundred milliliters and are acceptable for boating, fishing, and industry. Class C waters shall contain not less than five parts per million of dissolved oxygen with a hydrogen ion concentration within pH 5.0 to 8.5 and are acceptable for boating, fishing, and industrial use. Class D waters shall contain dissolved oxygen at all times. (Moulder-Fla)
W69-10036

WATER POLLUTION AND DISPOSAL OF WASTES.
NH Rev Stat Ann secs 149:4 thru 149:7 (1964), as amended (Supp 1967).

Descriptors: *New Hampshire, *Regulation, *Sanitary engineering, *Water pollution control, Legislation, Public health, Water pollution, Waste disposal, Surface waters, Industrial wastes, Stream pollution, Classification, Evaluation, Financing, Interstate.

The New Hampshire Water Pollution Commission shall supervise the administration and enforcement provisions concerning water pollution and waste disposal, study and investigate all problems connected with the pollution of surface waters, conduct scientific experiments concerning treatment of industrial wastes to control pollution of state surface waters, investigate and approve the applications of municipalities requesting available state or federal aid in the interest of pollution control, and confer with responsible authorities of other states concerning methods, means, and measures to be employed in controlling pollution in inter-state streams and other waters. The commission must follow certain procedures pertaining to notice, public hearing, and review of its classification of all streams, lakes, ponds, and tidal waters. After classification of any surface water, the Commission may reinvestigate the conditions of pollution and may make recommendations to the legislature for reclassification. (Moulder-Fla)
W69-10037

WATER POLLUTION AND DISPOSAL OF WASTES.
NH Rev Stat Ann secs 149:8 thru 149:19 (1964), as amended, (Supp 1967).

Descriptors: *New Hampshire, *Regulation, *Classification, *Pollution abatement, Legislation, Waste disposal, Evaluation, Pollution, Legal aspects, Water resources development, Public health, Standards, Water pollution control, Local governments, Industrial wastes.
Identifiers: Penalties, Enforcement.

The New Hampshire Water Pollution Commission shall enforce the adopted water classification by appropriate actions in the state courts. It is unlawful for any person to dispose of wastes in such a manner as to lower the classification of surface water below the minimum requirements of the adopted classification. If the quality of classification water is lowered by pollution, the person responsible shall be required to abate such pollution within a fixed time. If the pollution is of municipal or industrial origin, the time requirement is not less than two nor more than five years, which time limit may be extended by the Commission. Within six months after adoption of a given classification by the legislature, any person chargeable with the responsibility of abating pollution as a result of such classification may apply to the superior court in and for the county in which such pollution is occurring for a variance in such classification as applied to his specific case. The court, after a hearing, may enter a decree authorizing a variance from the classification in the specific case before it if such variance will not be contrary to the public interest. (Moulder-Fla)
W69-10038

RADIOECOLOGICAL SURVEILLANCE OF THE WATERWAYS AROUND A NUCLEAR FUELS REPROCESSING PLANT,
New York State Dept. of Health, Albany. Div. of Laboratories and Research; State Univ. of New York, Albany. Dept. of Biological Sciences; and State Univ. Coll., Fredonia, N.Y.
For primary bibliographic entry see Field 05C.
W69-10080

THE DECOMPOSITION OF PETROLEUM PRODUCTS IN OUR NATURAL WATERS,
Mississippi State Univ., State College. Dept. of Microbiology.
Lewis R. Brown, and Robert G. Tischer.
Miss State Univ Water Resources Research Inst Completion Rep, July 1969. 31 p, 8 fig, 3 tab, 5 ref. OWRR Proj no A-027-Miss.

Descriptors: *Biodegradation, *Oil wastes, *Surface waters, Water pollution control, Water chemistry, Microorganisms, Aquatic microorganisms, Bacteria, Toxicity, Fishkill, Phytotoxicity, Analytical techniques, Nutrients.
Identifiers: Oil spills, Oil pollution.

An investigation was made to study the decomposition of crude and refined petroleum in natural waters by investigating the physical, chemical, and microbiological changes that occur in fresh and brackish water environments during the decomposition of crude and refined petroleum products and investigating the effects of the microbial by-products on fish. The microflora caused marked physical changes in the oil under both aerobic and anaerobic conditions, using both fresh water and artificial seawater. The disappearance of oil was more rapid under aerobic conditions. A thin layer chromatographic technique was developed and employed to demonstrate chemical changes that occurred in the oil during microbial decomposition under all of the conditions employed. The addition of a nitrogen source and supplemental inorganic phosphate enhanced microbial activity. Waters in which the microbial degradation of oils had taken place were toxic for fish even after separation and removal of bacteria and oil. These data suggest that water-soluble products formed during the microbial decomposition of the petroleum products are harmful to fish. (Knapp-USGS)
W69-10082

OCCURRENCE OF SULFATE AND NITRATE IN RAINFALL,
Geological Survey, Washington, D.C.
Arlo W. Gambell, and Donald W. Fisher.
Journal of Geophysical Research, Vol 69, No 20, p 4203-4210, Oct 1964. 7 fig, 1 tab, 13 ref.

Descriptors: *Rainfall, *Sulfates, *Nitrates, Virginia, Atmosphere, Thunderstorms, Lightning, Sampling, Precipitation (Atmospheric), Snow, Chlorides, Calcium, Sodium, Potassium, Ammonia, Aerosols, Brines, Organic matter, Industrial plants, Agricultural chemicals, Evaporation, Winds, Water pollution sources.
Identifiers: Prince William National Forest Park (Va), Gaseous constituents, Soil dust, Sea-salt, Fossil fuels, Photochemical processes.

Authors studied the mineral composition of individual rainfalls at Prince William National Forest Park, Virginia. Data are presented showing variations in rainfall composition during the course of six storms. Sulfate, nitrate, chloride, calcium, sodium, and potassium ions were determined for all samples. Ammonium ion was determined only for thundershower samples. Easiest to account for are those constituents derived almost solely from particulate aerosols. These include calcium, sodium, and chlorine ions. With few exceptions, soil dust and sea-salt aerosols will adequately explain the presence of these. The data support the theory that much of the sulfate ion in rainfall is formed from the oxidation of sulfur dioxide in cloud droplets. It is suggested that atmospheric nitrogen peroxide, acting as a catalyst, is important in this reaction. The data indicate that sulfate ion, nitrate ion, and ammonium ion in rainfall are derived primarily from gaseous constituents of the atmosphere. Origin of nitrate ion in thunderstorm rainfall is discussed and evidence is given to show that role of lightning is almost certainly unimportant. High nitrate ion concentrations reported for thunderstorm rainfall could be explained by nitrogen oxides present in the air mass before a thunderstorm occurs. (Jones-Wis)
W69-10153

ALGAL RESPIRATION IN A EUTROPHIC ENVIRONMENT,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
Archie J. McDonnell, and R. Rupert Kountz.
Journal of Water Pollution Control Federation, Vol 38, No 5, p 841-847, May 1966. 5 fig, 3 tab, 9 ref.

Descriptors: *Algae, *Respiration, *Eutrophication, *Dissolved oxygen, Pennsylvania, Biochemical oxygen demand, Temperature, Flow, Sampling, Waste water disposal, Diurnal, Effluents, Nitrogen, Phosphates, Alkalinity, Fish, Streams, Water pollution effects, Water pollution sources, Nutrients.
Identifiers: Spring Creek (Pa), State College (Pa), Flora.

Present-day community development, especially in small watersheds, such as Spring Creek, Pennsylvania, has compounded problems of stream pollution criteria. In many stream situations, depletion of dissolved oxygen resources is a result not only of biochemical oxygen demand (BOD) but also of the effect of community respiration. Exactly how much effect each of these factors has on the dissolved oxygen level of the stream is difficult to evaluate. With statistical methods of regression and variance analysis, it was possible to define the BOD parameter as one of secondary engineering significance and to evaluate quantitatively the nocturnal oxygen demands of a heterogeneous stream flora. Community plant respiration varies directly with stream temperature and inversely with stream flow. Chemical analysis of contributing sources indicated nutrient concentrations sufficient to induce and maintain a eutrophic environment. On this basis, where population-to-receiving water resource ratio is high, analysis for significance of parameters other than BOD should be made and the findings manifested in the treatment process. The solution appears to lie in the removal of nitrogen and phosphorus from the wastewater treatment plant effluent before it enters the creek waters, which practically implies total exclusion. (Jones-Wis)
W69-10159

INDUSTRIAL POLLUTION OF INTERNATIONAL BOUNDARY WATERS ALONG THE NIAGARA FRONTIER,
H. H. Black and E. Devendorf.
Sewage and Indust. Wastes, Vol 26, p 1259-1285, 1954.

Descriptors: *Industrial wastes, Water pollution sources, Sewage.
Identifiers: *Flow rates.

Sources and types of pollution from the areas highly concentrated industries are described in relation to the use of the boundary waters. Despite tremendous flows in the rivers, there is a marked tendency in the upper Niagara River for sewage and industrial wastes to follow and remain along the shore. (Livengood-North Carolina)
W69-10291

WORKSHOP ON WATER RESOURCE PROBLEMS AND RESEARCH NEEDS RELATED TO AGRICULTURE IN THE COASTAL PLAINS OF NORTH CAROLINA.
North Carolina Water Resources Research Inst., Raleigh.
For primary bibliographic entry see Field 03F.
W69-10294

5C. Effects of Pollution

ARTIFICIAL DESTRATIFICATION IN RESERVOIRS OF THE CALIFORNIA STATE WATER PROJECT,
California State Dept. of Water Resources, Sacramento.
John R. Teerink, and Cecil Martin.
J Amer Water Works Ass, Vol 61, No 9, p 436-440, Sept 1969. 5 p, 2 fig, 2 tab, 16 ref.

Descriptors: *Stratification, *Reservoir operation, *Mixing, *Reaeration, *California, Thermal stratification, Economics, Cost-benefit analysis, Water circulation, Productivity, Water quality, Water chemistry.
Identifiers: Reservoir destratification.

Destratification and aeration in California reservoirs are accomplished by air injection and multiple-level outlet structures. Mixing returns nutrients to the photosynthetic zone for use by organisms, and oxidizes iron and manganese. The effects may be beneficial or detrimental to intended water uses. Evaporation is usually reduced because surface water temperatures are lowered. Dissolved oxygen is increased. Because artificial destratification can produce both benefits and detriments, a study should be made of priority of uses and the effects of mixing, and cost-benefit analyses should be made, placing a value on the various quality changes related to mixing. (Knapp-USGS)
W69-09883

WATER QUALITY OF MOUNTAIN WATERSHEDS,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 05B.
W69-09943

EPIDEMIC GIARDIASIS AT A SKI RESORT,
G. T. Moore, W. M. Cross, D. McGuire, C. S. Mollohan, and N. N. Gleason.
New Engl J Medicine, Vol 281, No 8, p 402, 407, Aug 21, 1969. 6 p, 3 fig, 2 tab, 35 ref.

Descriptors: *Water pollution effects, *Epidemics, *Protozoa, *Epidemiology, *Skiing, *Colorado, Sewers, Leakage, Diseases, Public health, Sewage, Recreation, Animal parasites, Pathology, Human diseases, Water pollution.
Identifiers: *Aspen (Colo), Giardiasis.

An outbreak of protracted, intermittent diarrhea, often associated with symptoms suggesting malabsorption, occurred in persons who vacationed in Aspen, Colorado, during the 1965-66 ski season. A survey of 1094 skiers showed that the characteristic illness had developed in at least 11.3%. The association of Giardia lamblia with the illness, the absence of other pathogens, and the response to treatment suggest that G. Lamblia was the agent responsible for the illness. Environmental studies carried out after the epidemic demonstrated contamination of well water by sewage leaking from defective pipes passing near wells. G. lamblia cysts were found in the sewage from the defective pipes and in stools from 6.9% of the permanent residents of the city living in the area served by the defective sewage lines. The findings are consistent with a hypothesis of water-borne spread of giardiasis. (Knapp-USGS)
W69-10079

RADIOECOLOGICAL SURVEILLANCE OF THE WATERWAYS AROUND A NUCLEAR FUELS REPROCESSING PLANT,
New York State Dept. of Health, Albany. Div. of Laboratories and Research; State Univ. of New York, Albany. Dept. of Biological Sciences; and State Univ. Coll., Fredonia, N.Y.
N. I. Sax, Paul C. Lemon, Allen H. Benton, and Jack J. Gabay.
Radio Health Data and Rep, Vol 10, No 7, p 289-296, July 1969. 8 p, 3 fig, 6 tab, 26 ref. USPHS Service grant, Nat Center for Radiological Health.

Descriptors: *Monitoring, *Radioisotopes, *Streams, Bioindicators, *New York, Nuclear wastes, Water pollution sources, Path of pollutants, Aquatic life, Algae, Silts, Ecology, Aquatic environment.
Identifiers: Cattaraugus Creek (NY).

A 3-yr study of the aquatic ecosystem around a nuclear fuels reprocessing plant, located in western New York State, was conducted to find and evaluate natural indicators of environmental contamination. The study covered preoperational and early post-operational phases. The ecological vectors selected for study were algae, silt, and fish, all from Cattaraugus Creek and its tributaries. Samples were collected at several points upstream and downstream from the plant effluent and quantita-

tively analyzed by gamma-ray spectrometry. All vectors analyzed indicated process of uptake and concentration of ruthenium-rhodium-106, cesium-137, cesium-134, and/or zirconium-niobium-95, and sometimes cobalt-60. In addition, the concept of using natural indicators not native to the streams under study was tested by translocating fresh water clams from Chautauqua Lake, 60 mi southwest of the site, and placing them in the streams around the plant. The clams not only thrived in their new environment but upon analysis showed definite interaction by concentration of the above radioisotopes, with the shells showing approximately twice the radioactivity of the soft parts of the clam. This concept might prove to be a sensitive indicator of environmental contamination. (Knapp-USGS)
W69-10080

THE DECOMPOSITION OF PETROLEUM PRODUCTS IN OUR NATURAL WATERS,
Mississippi State Univ., State College. Dept. of Microbiology.
For primary bibliographic entry see Field 05B.
W69-10082

EFFECTS OF SURFACE MINING ON THE FISH AND WILDLIFE RESOURCES OF THE UNITED STATES,
Bureau of Sport Fisheries and Wildlife, Washington, D.C.
Willard M. Spaulding, Jr., and Ronald D. Ogden.
Bur Sport Fish and Wildlife Resource Publication 68, Aug 28, 1968. 51 p, 3 fig, 31 photo, 10 tab, 18 ref, 3 append.

Descriptors: *Environmental effects, *Strip mines, *Acid mine water, Wildlife habitats, *Sport fishing, Strip mine lakes, Strip mine wastes, Edge effect, Habitats, Toxicity, Water pollution sources, Water pollution effects, Water pollution control, Data collections.
Identifiers: Surface mining effects, Fish and wildlife resources.

Data obtained in a study of the effects of surface mining on fishing resources are compiled. About 2 million acres of fish and wildlife habitat are damaged by mining. This includes 13,000 mi of streams (135,970 acres), 281 lakes (103,630 acres), 168 reservoirs (41,516 acres) and 1,687,288 acres of land; 62% of the damage is east of the Mississippi. Problems are discussed and recommendations are made for their solutions. (Knapp-USGS)
W69-10137

PROTECTION OF SMALL RIVERS UNDER INTENSIVE USE, TAKING THE MOSKVA RIVER AS AN EXAMPLE,
Akademiya Nauk SSSR, Moscow. Institut Biologii Vnutrennykh Vod.
S. M. Drachev, and V. Ye. Sinel'nikov.
Transl from Vestnik Moskovskogo Univertiteta, SEr. Geograf No 4, 1968, p 23-30. Soviet Hydrol Selec Pap No 3, p 284-289, 1968. 6 p, 1 fig, 4 tab, 15 ref.

Descriptors: *Water pollution, *Rivers, *Industrial wastes, *Municipal wastes, *Water pollution effects, Water pollution control, Biodegradation, Oxygen demand, Surfactants, Foaming, Path of pollutants, Water treatment, Waste treatment.
Identifiers: *USSR, *Moskva River.

Chemical and municipal pollution of the Moskva River, USSR cause changes which spread far from the sources of pollution. The Moskva River is a small river, 502 km long. In its upper reaches (285 km) it crosses the northwestern part of Moscow Province. From its head waters to the capital, the river flows over the Klin-Mozhaysk morainic plain, interrupted by the basins of old lakes and hollows. Much of the Moskva River catchment above the capital is included in a sanitary protection zone, covering 7,300 sq km. The work performed in the sanitary protection zone included the drainage of bogs, forest conservation for controlling soil erosion, and construction of sewage treatment plants in populated areas. The construction of industrial buildings is prohibited in the protection zone. More than 200 populated areas, mainly villages and vacation spots, are located in the second belt of the sanitary protection zone. The sewage is treated at biological stations and filtration fields. The Moskva River in the city and especially below it has been changed in hydrologic regime, banks and bottom, and the mineral and organic composition of water. The number, composition, and leading species of water organisms have changed. By 1980, the release of sewage into the Moskva River after purification will amount to 60 cu m/sec. The water at the intakes of the Rubley and Zapadnaya water works is slightly colored, highly mineralized, very transparent, and has a small content of organic substances. The impurities derived from the city concentrate at the Pererva dam to the southeast of the Moscow city limit. The highest concentrations of industrial pollution indexes were found in this river reach, including chromium, lead, cobalt, molybdenum, and surfactants. (Knapp-USGS)
W69-10139

A METHOD FOR THE DETERMINATION OF ZERO THICKNESS ACTIVITY OF CARBON-14 LABELED BENTHIC DIATOMS IN SAND,
Marine Lab., Aberdeen (Scotland); and Michigan State Univ., Hickory Corners. W. K. Kellogg Biological Station.
For primary bibliographic entry see Field 02L.
W69-10150

THE MEASUREMENT OF CHLOROPHYLL, PRIMARY PRODUCTIVITY, PHOTOPHOSPHORYLATION, AND MACROMOLECULES IN BENTHIC ALGAL MATS,
Indiana Univ., Bloomington. Dept. of Microbiology.
Thomas D. Brock, and M. Louise Brock.
Limnology and Oceanography, Vol 12, No 4, p 600-605, Oct 1967. 1 fig, 2 tab, 13 ref.

Descriptors: *Benthic flora, *Chlorophyll, *Primary productivity, *Measurement, Proteins, Radioactivity, Carbon radioisotopes, Phosphorus radioisotopes, Algae, Biochemistry, Ecology, Sampling, Thermal springs, Effluents, Cyanophyta.
Identifiers: *Photophosphorylation, *Macromolecules, Nucleic acid, Ribonucleic acid synthesis.

This is part of a study of the biochemical ecology of thermal environments. Along the gradients of hot-spring effluents, algae develop on the bottoms of sinter-lined channels. Thickness and consistency of the mat is determined by temperature, flow rate, and type of flow--whether turbulent or laminar. In channels with laminar flow, the algal mats are relatively uniform over several square decimeters. Methods are described for measuring primary productivity, chlorophyll, protein, and nucleic acid in algal cores. The cores are homogenized after incubation with a radioactive isotope allowing representative subsampling. Isotope self-absorption is not a problem, because only a small fraction of the core is actually filtered. The method eliminates sampling variability since chlorophyll is estimated in the same samples used to determine carbon-14 (C-14) uptake. Acid or alkali extraction was used to indicate the biochemical fractions into which the C-14 was incorporated. Total phosphate content of the spring water was determined chemically for calculation of specific radioactivity of phosphate-32 (P-32) ion. Rates of photophosphorylation and ribonucleic acid synthesis were measured using P-32. All work was done with blue-green algae, and method should not be applied to other algae without preliminary testing. (Jones-Wis)
W69-10151

QUANTITATIVE RELATIONS OF THE FEEDING AND GROWTH OF DAPHNIA PULEX OBTUSA (KURZ) SCOURFIELD,
Department of Water Technology, Prague (Czechoslovakia).
N. M. Kryutchkova, and V. Sladecek.
Hydrobiologia, Vol 33, No 1, p 47-64, 1969. 9 fig, 4 tab, 51 ref.

Descriptors: *Feeding rates, *Growth rates, *Daphnia, Productivity, Bioindicators, Secondary productivity, Aquatic productivity, Water pollution effects, Yeasts, Crustacea, Algae.
Identifiers: *Daphnia pulex obtusa, Scenedesmus quadricauda, Ecological efficiencies, Trophic ecology, Cladocera.

Authors fed individual newborn cladocerans, Daphnia pulex obtusa, three concentrations of yeast (5, 10, 20 milligrams/liter), or algae, Scenedesmus quadricauda, 5, 10 15 milligrams/liter) in ten replicated experiments per treatment. Duration of life, growth, and fecundity were recorded for each daphnid. With increasing concentrations of yeast, mean total egg production increased from 101 to 192; with algae, from 154 to 270. Mean body-length of daphnid fed yeast attained 2.4 millimeters; algae fed, 2.9 millimeters. Of total production (body weight+ egg weight), 66-75% was utilized for reproduction in entire period to death, beginning 5-6 days after inception of sexual maturity. Relative average daily daphnid growth (ADG) was greater in early life, decreasing with age; increased with increasing concentrations of food, and was greater with algal food than with yeast. Authors claim that values for ADG (range: 0.23-0.46 for all treatments) are high and indicate that this daphnia is adapted for life in polluted water. For increasing algal concentrations, average daily ratio increased (39.1%, 58.8%, 75.9% daphnid dry weight); efficiency of food-utilization for growth decreased (56.1%, 47.9%, 35.7%). Filtration rate for life span decreased with increasing algal concentration from 842.3 to 400 milliliters/milligram dry daphnid weight. (Eichhorn-Wis)
W69-10152

FIELD AND EXPERIMENTAL WINTER LIMNOLOGY OF THREE COLORADO MOUNTAIN LAKES,
Colorado Univ., Boulder. Dept. of Biology.
For primary bibliographic entry see Field 02H.
W69-10154

EXTRACELLULAR PRODUCTION IN RELATION TO GROWTH OF FOUR PLANKTONIC ALGAE AND OF PHYTOPLANKTON POPULATIONS FROM LAKE ONTARIO,
Scarborough Coll., Toronto (Ontario).
C. Nalewajko, and L. Marin.
Canadian Journal of Botany, Vol, 47, p 405-413, 1969. 8 fig, 3 tab, 9 ref.

Descriptors: *Plankton, *Algae, *Phytoplankton, *Lake Ontario, *Growth rates, Environmental effects, Photosynthesis, Diatoms, Chlorella, Carbon radioisotopes, Light intensity, Cultures, Radioactivity, Carbon dioxide, Water pollution effects, Water pollution sources.
Identifiers: *Extracellular production, *Carbon fixation, *Excretion, Stephanodiscus tenuis, Asterionella formosa, Melosira binderana, Generation time, Chlorella pyrenoidosa, Diatoma elongatum, Melosira islandica, Nitzschia acicularis, Nitzschia dissipata, Synedra acus, Sinking rates, Grazing pressure, Population density.

Authors present data on relationship between photosynthesis and extracellular production and relative growth rate in four planktonic algae. Three are diatoms abundant in Lake Ontario; the fourth species, Chlorella pyrenoidosa Chick, was included for comparison. All cultures were grown under low light and stirred continuously. At various stages of growth the carbon-14 method was used to measure photosynthesis and excretion on exposure to high

light intensity. Additionally, photosynthesis and excretion were measured during spring (1966) increase of diatoms in Lake Ontario. Growth rates of planktonic algal populations cannot be measured since factors such as sinking and grazing may mask the true rate. However, such data were thought to be useful for comparison with laboratory experiments, particularly since two of the species studied in culture were of quantitative importance in the bloom. In the four species, both carbon fixation and excretion (on basis of ash-free dry weight) increase with relative growth rate of cultures measured in logarithmic (to base 10) units. In natural populations, percentage excretion values are postively correlated with relative growth rates, however, environmental factors may be of relatively greater importance and determine the extent of excretion. (Jones-Wisconsin)
W69-10158

TEMPERATURE OPTIMA FOR ALGAL DEVELOPMENT IN YELLOWSTONE AND ICELAND HOT SPRINGS,
Indiana Univ., Bloomington. Dept. of Bacteriology.
T. D. Brock, and M. Louise Brock.
Nature, Vol 209, No 5024, p 733-734, Feb 1966. 2 fig, 7 ref.

Descriptors: *Algae, *Temperature, *Hot Springs, Habitats, Alkaline water, Acidic water, Travertine, Calcium carbonate, Bacteria, Biomass, Chlorophyll, Proteins, Light, Nutrients, Hydrostatic pressure, Carbon dioxide, Cyanophyta, Physiological ecology, Thermal water.
Identifiers: *Yellowstone National Park, *Iceland hot springs, Sinter, Nucleic acid, Sisjothandi (Iceland), Enzyme-substrate complexes, Ribonucleic acid, Orcinol method.

In analyzing environmental factors affecting growth, study of habitats where only a single factor varies is desirable. In hot springs temperature is the only variable and its relation to biological development can be measured directly. In the Yellowstone springs, alkaline, acid, and travertine-depositing, high in calcium carbonate, exhibit the greatest biological development. Over siliceous sinter cones, where constant and uniform thermal gradients may exist, blue-green algae proliferate. Pools were chosen where initial chemical composition of water flowing over all organisms along the thermal gradient is identical. The extent of algal development is influenced by amount and rate of water flow and, since springs differed in this factor, they also differed in algal content, while exhibiting similar thermal gradients. Samples were taken whenever possible from areas having identical amounts and rates of water flow. Chlorophyll content was estimated and ribonucleic acid and protein assays made. These results were expressed showing relationship between temperature of sample and biochemical content per unit area. Species number and composition changed along the gradient. The optimum temperature for algal development in these alkaline springs is 51-56 degrees C. Temperatures were lower in Iceland springs and hydrogen ion concentration higher. (Jones-Wis)
W69-10160

THE HABITAT OF LEUCOTHRIX MUCOR, A WIDESPREAD MARINE MICROORGANISM,
Indiana Univ., Bloomington. Dept. of Bacteriology.
Thomas D. Brock.
Limnology and Oceanography, Vol 11, No 2, p 303-307, April 1966. 2 fig, 7 ref.

Descriptors: *Marine microorganisms, *Habitats, Epiphytology, Marine algae, Ecology, Cultures, Washington, Waves (Water), Connecticut, Rhode Island, Temperature, Nutrient requirements, Physiocochemical properties, Physiological ecology, Rhodophyta, Chlorophyta.
Identifiers: *Leucothrix mucor, Morphology, Friday Harbor (Wash), Antithamnion sarniense, Rhodochorton, Bangia fusco-purpurea, Sphacelaria, Gonidia, Callophyllis haenophylla, Tidal current, Puget Sound (Wash), Long Island Sound, Narragansett Bay, Cape Reykjanes, Faxafloi Fjord, Iceland, DNA base composition.

Leucothrix mucor is a large, widespread marine microorganism with characteristic orphological features recognizable in natural collections. It grows as an epiphyte on marine algae, occurring most extensively on rhodophytes (red algae) and on filamentous green algae. Author describes method of isolation and success in extensive epiphytic grown on algae in the laboratory, concluding that the alga not only provides a substratum for attachment of Leucothrix, but also nutrients for its growth. The algal cultures, which have been maintained through successive transfers made over several months, are apparently not harmed in any way by attachment and growth of L mucor. In nature, a wide variety of filamentous and leafy rhodophytes are colonized with L mucor. Where water is still or slow moving, L mucor is rare, but it occurs in extremely high densities on rhodophytes growing in rapidly moving water. All isolates in pure culture have been remarkably similar in physiological and morphogenetic behavior, having similar temperature optima and nutritional requirements. Six strains have deoxyribonucleic acid demonstrating identical base composition. Thus, the species, as defined morphologically, comprises a homogeneous group of strains physiologically and biochemically. (Jones-Wis)
W69-10161

THE RELATIONSHIP OF THE DISTRIBUTION OF THE DIATOM SKELETONEMA TROPICUM TO TEMPERATURE,
Woods Hole Oceanographic Institution, Mass.
Edward M. Hulburt, and Robert R. L. Guillard.
Ecology, Vol 49, No 2, p 337-339, Spring 1968. 2 fig, 1 tab, 38 ref.

Descriptors: *Diatoms, *Temperature, *Distribution, Atlantic Ocean, Washington, Pacific Ocean, Caribbean Sea, Panama Canal, Gulf of Mexico, Growth rates, Light intensity, Neritic, Phytoplankton, Physiological ecology.
Identifiers: *Skeletonema tropicum, Skeletonema costatum, Chromatophores, Latitude 30 deg, Friday Harbor (Wash), South America, Clones, Thalassiosira nordenskioldii, Chaetoceros didymus, Nannachloris, Cyclotella nana, Sargasso Sea, Asterionella japonica, Rhizosolenia setigera, Thalasionema nitzschioides, Cape Hatteras, Cape Cod.

Skeletonema tropicum is distinguished from S costatum in possessing a greater number of chromatophores than the latter. S tropicum is found north of the equator, as far as latitude 30 degrees in the western Atlantic Ocean, whereas the ubiquitous S costatum extends into the colder waters north. Reason for the limited distribution of S tropicum, as determined by growth of unialgal cultures, is its inability to live at temperatures lower than 13 deg C. Such a distribution shows that, although S tropicum extends farther north than previous records indicate, it does not extend north of Cape Hatteras, where winter temperatures are below 10 deg C. Other phytoplankton species isolated from tropical waters are unable to grow at low temperatures. There are apparently southern and northern races of these species. However, Skeletonema tropicum does not appear to occur in northern waters, and this is apparently due to the absence of cold water races. S tropicum, though neritic in distribution, can be carried some distance beyond the continental shelf. Thus, one can speculate that it might be carried beyond latitude 30 degrees to become a resident in coastal water north of Cape Hatteras, if it could withstand cold winter temperatures. (Jones-Wis)
W69-10162

THE APPLICATION OF MICRO-AUTORADIOGRAPHIC TECHNIQUES TO ECOLOGICAL STUDIES,
Indiana Univ., Bloomington. Dept. of Microbiology.
For primary bibliographic entry see Field 07B.
W69-10163

ON CONTROL OF LAKE EUTROPHICATION: EMPIRICAL AND EXPERIMENTAL INVESTIGATIONS PERTINENT TO THE KNOWLEDGE OF LIMITING CHEMICAL COMPOUNDS IN 46 LAKES OF SWITZERLAND AND BORDER REGIONS-- (IN GERMAN),
Kantonales Laboratorium, Zurich (Switzerland).
E. A. Thomas.
Schweizerischen Vereins von Gas- und Wasserfachmannern, Jahrgang 1953, No 2 and 3, p 1-15. 3 tab, 39 ref.

Descriptors: *Water pollution control, *Eutrophication, *Lakes, Phosphates, Phosphorus compounds, Phosphorus, Nitrates, Limiting factors, Nitrogen, Oligotrophy, Ammonia, Water chemistry, Water pollution effects, Phytoplankton.
Identifiers: *Switzerland, *Chemical limnology, *Limiting constituents, Lake Como (Switzerland), Lake Maggiore (Switzerland), Lake Lugano (Switzerland), Lake Zurich (Switzerland), Mesotrophy.

As shown by culture trials, the growth of algae in investigated lakes is largely influenced by high contents of nitrates and phosphates, whereas elements or compounds present in minute amounts (minimumstoffe) are of little significance. In virgin oligotrophic and partly mesotrophic lakes, not affected appreciably by man's activity, phosphorus appears as a limiting constituent. Depending on varying annual conditions, either nitrogen or phosphorus may become limiting constituents. Appreciable amounts of nitrites and ammonia in eutrophic lakes are confined to the winter period and to the surface layer of water. Aside from the difference between the contents of nitrogen and phosphorus compounds in the surface water layer, the intensity of calcium precipitation provides a criterion of the phytoplankton production. Where phosphorus is a limiting constituent, an increase in its supply will lead to eutrophication of the lake. Where the summer content of nitrate is a limiting constituent, reduced nitrogen fertilization may partly preclude eutrophication; however, the best control even in this case is a drastic reduction of the supply of phosphorus compounds. (Wilde-Wis)
W69-10164

SOME FEATURES OF SALINE LAKES IN CENTRAL WASHINGTON,
Washington Univ., Seattle. Dept. of Zoology; and Washington Univ., Seattle. Dept. of Oceanography.
For primary bibliographic entry see Field 02H.
W69-10165

ALGAE AND PHOSPHORUS IN LAKE MINNETONKA,
Minnesota Univ., Minneapolis. Limnological Research Center.
Robert O. Megard.
Limnological Research Center, Minnesota Univ, Minneapolis, Interim Report No 4, 27 p, December 1968. 9 fig, 3 ref. OWRR Project A-016-MINN.

Descriptors: *Algae, *Phosphorus, *Minnesota, *Eutrophication, Pollution abatement, Growth rates, Chlorophyll, Photosynthesis, Chemical analysis, Bacteria, Nutrients, Temperature, Epilimnion, Nitrogen compounds, Sewage effluents, Light intensity, Lakes, Water pollution sources, Water pollution effects, Water pollution control, Nitrates, Nitrogen fixation.
Identifiers: *Lake Minnetonka (Minn), Lake management program, Algal density, Aphanizomenon, Melosira, Lyngbya.

Data indicate that phosphorus is the critical nutrient for algae in Lake Minnetonka, Minnesota, during summer. The relationship between algae and nitrogen was not studied in detail but nitrate is apparently not critical at any time. This is presumably due to synthesis of nitrate from dissolved gaseous nitrogen by dominant algas in summer. Phosphorus probably was not a limiting

nutrient in spring, at which time another substance, possibly nitrogen, was limiting. Detailed analyses of nutrient budgets and water balances will be required to determine what must be done to restore Lake Minnetonka, and requisite time and cost of programs. Initial objective of an interim program should be to reduce influx of phosphorus from the watershed. Most of phosphorus comes from sewage effluents, controllable either by advanced treatment or by diversion. Deterioration of the lake will be retarded even if only moderate quantities of nutrients are prevented from entering. All municipalities must cooperate. Lake Minnetonka will improve only when annual nutrient losses exceed influx. Further study can resolve whether advanced sewage treatment with abatement of other sources of nutrients, or sewage diversion, will be required. (Jones-Wis)
W69-10167

OBSERVATIONS ON EXCESSIVE WEED GROWTH IN TWO LAKES IN NEW ZEALAND,
Marine Dept. Rotorua (New Zealand).
G. R. Fish.
New Zealand Journal of Botany, Vol 1, p 410-418, December 1963. 1 fig, 2 tab, 7 ref.

Descriptors: *Weed control, *Lakes, Boating, Fishing, Ecology, Arsenic compounds, Herbicides, Temperature, Eutrophication, Rainbow trout, Trout, Brown trout, Bottom sediments, Sampling, Crayfish, Limnology, Sulfates, Dissolved oxygen, Water analysis, Bacteria, Diatoms, Cyanophyta, Snails, Mussels, Worms, Plant tissues, Phytoplankton, Plant growth, Water pollution effects, Water pollution sources.
Identifiers: *New Zealand, Lake Rotorua (N Z), Lake Rotoiti (N Z), Lagarosiphon major, Elodea canadensis, Faunas, Salmo gairdnerii, Geothermal activity, Nitella leonhardii, Freshwater sponges, Potamopyrgus corolla, Physastra variabilis, Potamopyrgus antipodum, Chironomid larva, Retropinna lacustris, Tolerance, Hyridella menziesi, Paranephros planifrons.

A water weed, Lagarosiphon major (Ridley) Moss, native of South Africa, growing during recent years in New Zealand lakes Rotorua and Rotoiti, has become sufficiently abundant to threaten normal use of lacustrine facilities, including angling and boating. The excessive growth largely results from enrichment of the drainage area by domestic sewage. Data bearing on ecology of the weed are presented from results of a survey made during 1961. Isolated occurrence of Lagarosiphon extending to the surface through 40 feet of water have been reported. Usually, this plant reaches the surface only in water shallower than about 8 feet, where growth is sufficiently dense to exclude fish, and sometimes, snails. An arsenical herbicide failed to control weed growth, possibly because of low temperatures of the lake water, or of an acquired tolerance to the poison since high arsenic levels were preexistent in the plants and bottom deposits of the lakes. Such levels probably result from geothermal activity, evident in many places around the shores and often associated with deposition of arsenical salts. Further eutrophication in these lakes is likely to contribute to deterioration of a valued trout fishery. (Jones-Wis)
W69-10168

ARTIFICIAL EUTROPHICATION OF LAKE WASHINGTON,
Washington Univ., Seattle. Dept. of Zoology.
W. T. Edmondson, G. C. Anderson, and Donald R. Peterson.
Limnology and Oceanography, Vol 1, p 47-53, 1956. 3 fig, 1 tab, 27 ref.

Descriptors: *Washington, *Lakes, *Eutrophication, Sewage, Biota, Phytoplankton, Diatoms, Dinoflagellates, Algae, Hypolimnion, Oxygen, Productivity, Phosphates, Chlorophyll, Epilimnion, Effluent, Temperature, Photosynthesis, Carbon dioxide, Depth, Thermocline, Zooplankton, Tripton, Bacteria, Sedimentation, Copepods, Water pollution sources, Water pollution effects.
Identifiers: *Lake Washington (Wash), Oscillatoria rubescens, Switzerland, Peridinium, Oscillatoria agardhi, Phormidium, Aphanizomenon flos-aquae, Secchi disc transparency, Anabaena lemmermanni, Aphanocapsa, Bosmina longispina, Zurichsee (Switzerland), Linsley Pond (Conn), Bosmina coregoni longispina.

Lake Washington has been receiving increasing amounts of treated sewage, and appears to be responding by changes in type and quantity of biota. In 1933 and 1950, dominant phytoplankton organisms were Anabaena and various diatoms and dinoflagellates, but in 1955, apparently for the first time, large populations of blue-green alga, Oscillatoria rubescens, occurred, a species, which constitutes nuisance blooms in many lakes. An interesting ecological problem exists in connection with the two species of Oscillatoria in Lake Washington, O agardhi and O rubescens. The replacement of one by another may imply a distinct, but perhaps subtle difference in ecological requirements. A great increase in the hypolimnetic oxygen deficit is considered as evidence of increased productivity; the deficit was 1.18 micrograms per square centimeter per month in 1933, 2.00 in 1950, and 3.13 in 1955. Decrease in oxygen is fairly closely related to increase in hypolimnetic phosphate concentration between measurements, much less closely related to the chlorophyll concentration in the epilimnion. Further study of Lake Washington as its eutrophication proceeds or, if effluents are diverted, of the extent to which the lake regains its former, more oligotrophic, condition will be valuable. (Jones-Wis)
W69-10169

EUTROPHICATION OF LAKES AND RIVERS: ITS ORIGIN AND PREVENTION (IN GERMAN),
Kantonales Laboratorium, Zurich (Switzerland).
E. A. Thomas.
Vierteljahrsschrift der Naturforschenden Gesellschaft, Zurich, Vol 107, No 3, p 127-140, 1962. 24 ref. In German.

Descriptors: *Lakes, *Rivers, *Eutrophication, Runoff, Fertilizers, Nutrients, Nitrates, Phosphates, Phytoplankton, Iron compounds, Algae, Plants, Water pollution effects, Water pollution sources, Water pollution control, Limnology, Diversion, Streams.
Identifiers: Aluminum sulfate, Iron chloride, Iron sulfate, Cladophora blankets, Hydrodictyon, Macrophytes.

Runoff, even when deprived of its mechanical and biogenic constituents by purification, provides rich fertilizer for algae and higher plants of streams and lakes. Nitrates and phosphates are particularly important stimulants which induce various harmful consequences. Removal of phosphates from the runoff by the use of suitable chemical reactions constitutes a direct control measure inhibiting eutrophication. The possibility of diversion if dissolved phosphates for production of farm crops is suggested. The method of eutrophication control must be determined by the limnological characteristics of water in question. (Wilde-Wisc)
W69-10170

SEDIMENTS FROM DANISH LAKES,
Copenhagen Univ. (Denmark). Geographical Lab.
For primary bibliographic entry see Field 02H.
W69-10174

REMOVAL OF ORTHOPHOSPHATES FROM AQUEOUS SOLUTIONS WITH ACTIVATED ALUMINA,
Northwestern Univ., Evanston, Ill. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 05G.
W69-10176

STUDIES ON MORPHOGENESIS IN A BLUE-GREEN ALGA. I. EFFECT OF INORGANIC NITROGEN SOURCES ON DEVELOPMENTAL MORPHOLOGY OF ANABAENA DOLIOLUM,
Rajasthan Univ., Jaipur (India). Dept. of Botany.
H. N. Singh, and B. S. Srivastava.
Canadian Journal of Microbiology, Vol 14, p 1341-1346, 1968. 5 fig, 2 tab, 12 ref.

Descriptors: *Physiological ecology, *Environmental effects, *Morphology, *Algae, Aquatic microbiology, Cyanophyta, Essential nutrients, Nitrogen compounds, Ammonia, Nitrates, Nitrites, Nutrient requirements, Nutrients, Phytoplankton, Inhibition.
Identifiers: *Anabaena doliolum.

Spore germination, heterocyst production, hormogone formation, and sporulation are the morphogenetic stages in development of Anabaena doliolum. In basal medium, sporulation is simultaneous while heterocyst formation is sequential. Nitrate-, Nitrite-, and ammonium-nitrogen inhibit sporulation and heterocyst formation, degree of inhibition depending on concentration and source of inorganic nitrogen. Nitrate and nitrite induce lysis which is concentration dependent and circumscribed by time, i e, up to a certain stage the lytic events are preventable by transfer to basal medium, but beyond this stage they become inevitable and complete lysis occurs even in absence of nitrate or nitrite. Sequential differentiation and spatial relations of heterocysts in a growing filament are characteristic of each nitrogen source and indicative of the polarity involved in gradient of heterocyst formation. (Fitzgerald-Wis)
W69-10177

EXCESSIVE WATER FERTILIZATION,
Wisconsin Dept. of Resource Development, Madison. Water Resources Div.
Richard B. Corey, Arthur D. Hasler, G. Fred Lee, F. H. Schraufnagel, and Thomas L. Wirth.
Report to Water Subcommittee, Natural Resources Committee of State Agencies, Madison, Wisconsin, 50 p, January 1967. 7 tab, 131 ref.

Descriptors: *Water, *Fertilization, *Eutrophication, Lakes, Streams, Algae, Fish, Wisconsin, Sewage, Trout, Nitrogen, Phosphorus, Detergents, Runoff, Percolation, Roads, Roofs, Precipitation (Atmospheric), Wetlands, Seepage, Industrial wastes, Tertiary treatment, Chemical precipitation, Harvesting, Zoning, Diversion, Dredging, Impoundments, Weeds, Sports, Property values, Taste, Odor, Base flow, Lake Mendota (Wis), Bottom sediments, Municipal wastes, Water pollution effects, Water pollution sources, Water pollution control.
Identifiers: Manure, Madison (Wis), Flushing waterways, Milwaukee (Wis), Chicago (Ill), Artificial circulation, Nuisances.

Deterioration of Wisconsin waters will probably increase. Excessive fertilization will become the important public problem in water resources. Domestic sewage constitutes a major source of nitrogen and phosphorus, apparently the major causative elements of eutrophication. Accelerated use of synthetic detergents accentuates a problem to which many other factors contribute: runoff and underground percolation from rural lands; manure applied on frozen soil; runoff from roofs and roads; 'washing' of the atmosphere by precipitation; and release of nitrogen and phosphorus resulting from development of wetlands for agricultural and urban use. Improved removal of nutrients from sewage appears possible. Adding tertiary treatment for effluents; perfecting use of chemical precipitants; biochemically removing nutrients by growing and harvesting algae in effluent lagoons; removing nutrients by modification of activated sludge processes; liquidizing and storing winter manure until spring--all may prove effective. Entire drainage basins, shores and frontages, may require rezoning. Diversion of effluents, flushing waterways with clear water, chemically controlling algae and aquatic plants, dredging shallow portions of lakes, artificially circulating entire lakes, drawing nutrient-rich surplus water from lake bottoms, im-

ounding streams and controlling subsequent releases-tall show promise. (Jones-Wis)
W69-10178

THE IMPORTANCE OF EXTRACELLULAR PRODUCTS OF ALGAE IN FRESHWATER,
University Coll., London (England). Dept. of Botany.
G. E. Fogg, and D. F. Westlake.
Verh Int Verein Theor Angew Limnol, Vol 12, p 219-232, 1953. 3 fig, 2 tab, 20 ref.

Descriptors: *Algae, *Fresh water, *Peptides, Copper, Iron, Ions, Phosphates, Organic compounds, Toxicity, Chlorophyta, Lakes, Reservoirs, Nitrogen, Growth, Amino acids, Chlamydomonas, Chlorella, Wisconsin, Lake Michigan, Phytoplankton, Diatoms, Ecology, Soil, Cultures, Cyanophyta, Water pollution sources, Water pollution effects.
Identifiers: *Extracellular products, Anabaena cylindrica, Zinc, Xanthophyceae, Bacillariophyceae, Myxophyceae, Complex formation, Growth-promoting properties, Chlamydomonas moewusii, Chlorella pyrenoidosa, Tribonema aequale, Navicula pelliculosa, Lake Mendota (Wis), England, London (England), Esthwaite (England), Loweswater (England), Barnes South Reservoir (England), Windermere North Basin (England), Loughrigg Tarn (England), Basenthwaite (England), Tarn Tarn (England), Solway Firth (England), Little Haweswater (England), Staines Reservoir (England), Gloeotrichia natans, Oscillatoria, Botryococcus, Volvox, Uroglena, Aphanizomemon, Microcystis, Coelosphaerium.

Experiments with partially purified preparations of the extracellular polypeptide, produced during normal growth of the cyanophyte (blue-green alga), Anabaena cylindrica, show that this material forms complexes with various ions including those of copper, zinc, ferric iron, phosphate and certain organic substances. Authors suggest that such complex formation may have biologically important effects, and, as an example, they suggest that complex formation between extracellular polypeptide and cupric ion considerably reduces toxicity of the latter toward Anabaena cylindrica. This may explain the erratic results often obtained with copper sulphate used as an algicide. Algae representing other classes (Chlorophyceae, Xanthophyceae, Bacillariophyceae) also produce extracellular peptide. That relatively substantial amounts of peptide-nitrogen occur dissolved in lake waters has been confirmed for a number of English lakes and reservoirs. Authors suggest that this peptide may originate partially from living algae and that by forming complexes with other dissolved substances, it may exert important effects on growth of aquatic organisms. Specific substances may not be necessary, and in lakes, complex-forming substances derived from organic decay or living algae, may effectively produce the requisite environment for cyanophytes. (Jones-Wis)
W69-10180

CHANGES IN THE OXYGEN DEFICIT OF LAKE WASHINGTON,
Washington Univ., Seattle. Dept. of Zoology.
W. T. Edmondson.
Verh Int Verein Theor Angew Limnol, Vol 16, p 153-158, Dec 1966. 3 fig, 1 tab, 8 ref.

Descriptors: *Washington, *Oxygen, *Fluctuation, Sewage treatment, Solar radiation, Chlorophyll, Productivity, Photosynthesis, Algae, Hypolimnion, Epilimnion, Phytoplankton, Seston, Crustaceans, Diatoms, Chlorophyta, Deposition (Sediments), Watersheds (Basins), Water pollution effects, Cyanophyta, Eurtrophication.
Identifiers: *Lake Washington (Wash), *Oxygen deficit, Secchi disc transparency, Myxophycea, Oscillatoria, Anabaena, Diaptomus ashlandi, Epischura nevadensis, Diaphanosoma leuchtenberganum, Cyclops bicuspidatus, Reproductive rate.

Records of recent changes in oxygen regime in Lake Washington show that, though increasing amounts of effluent from sewage treatment plants were received and oxygen deficit rate, in general was higher in 1956 to 1964 than in 1933 and 1950, the increase fluctuated and, in some years, rate was similar to that of 1950. Changes in deficit do not appear to be attributable to corresponding changes in productivity. No clear relation appears between deficit and chlorophyll or solar radiation input. Thus the lake has continued to show signs of enrichment by increased primary productivity and algal abundance, while oxygen deficit and its rate of development during the summer have not changed proportionately. A partial explanation may lie in qualitative changes in character of phytoplankton. A relatively small fraction of the 1950 population consisted of colonial Myxophyceae, whereas in 1961-1964, they dominated the population. The rate of deposition of material to the bottom, whose substances support the oxygen deficit, appears not to have increased correspondingly to productivity or crop. There is no indication that changes in oxygen deficit are attributable to changes in watershed of lake. (Jones-Wis)
W69-10182

CHEMICAL TREATMENT OF OIL SLICKS, A Status Report on the Use of Chemicals and Other Materials to Treat Oil Spilled on Water.
Federal Water Pollution Control Administration, Edison, N. J. Water Quality Lab.
For primary bibliographic entry see Field 05D.
W69-10252

POLYMERS FOR SEWER FLOW CONTROL, The Development and Demonstration of the Use of Polymers to Reduce or Eliminate Sewer Overflows by Flow Energy Reduction.
Federal Water Pollution Control Administration, Washington, D.C.

Available from the Clearinghouse as PB 185951, $3.00 in paper copy, 0.65 in microfiche. Water Pollution Control Research Series, Report WP-20-22, Aug 1969. 180 p, 36 tab, 75 fig, 10 ref, 4 append. FWPCA Contract No. 14-12-34. Program No. 11020 DIG.

Descriptors: Infiltration, Overflow, Toxicity, Sewers.
Identifiers: *Polymers, *Overflow control, Friction reduction, Economic analysis, Toxicity test, *Sewer lines, Sewer flow control.

Six water-soluble polymers were investigated to determine their effects upon aquatic flora and fauna, flow characteristics of wastewater, and the operation of a wastewater treatment plant. It was found that the polymers and gels, in the magnitudes tested, were not toxic to bacteria, algae, or fish, and did not act as a nutrient for algae growth. Based upon calculations obtained from flow test data, a maximum flow increase of 2.4 times the flow prior to injection could be obtained if a constant head was maintained. Laboratory flow test data indicated that if flow rates were held almost constant prior to and during polymer injection, a reduction in the static head occurred as a result of friction reduction within the fluid. The most effective polymers in providing energy reduction were Polyox Coagulant-701, WSR-301, and AP-30; however, AP-30 required higher polymer concentrations to obtain equivalent flow characteristics. In field tests on a 24-inch diameter line, it was found that polymer concentrations of between 35 and 100 mg/l, decreased frictional flow resistance sufficiently to eliminate surcharges of more than six feet. Based upon an economic analysis, the average annual cost of new construction was approximately five times the cost of using polymers during peak storm-flow periods.
W69-10256

WORKSHOP ON WATER RESOURCE PROBLEMS AND RESEARCH NEEDS RELATED TO AGRICULTURE IN THE COASTAL PLAINS OF NORTH CAROLINA.
North Carolina Water Resources Research Inst., Raleigh.
For primary bibliographic entry see Field 03F.
W69-10294

5D. Waste Treatment Processes

WATER REUSE: A TEXAS NECESSITY,
Texas Water Quality Board, Austin.
R. D. Fleming, and H. D. Jobes.
J Water Pollut Contr Federation, Vol 41, No 9, p 1564-1569, Sept 1969. 6 p, 2 fig, 1 tab.

Descriptors: *Water reuse, *Water demand, *Texas, Irrigation water, Industrial water, Municipal water, Waste water treatment, Economics, Water allocation (Policy), Water management (Applied).
Identifiers: Texas Water Plan.

By the year 2020, Texas' estimated 33.5 million people will need 12 mil acre-ft of water for municipal and industrial uses, and over 16 mil acre-ft for irrigation. Because the annual safe yield of ground and surface water is only 20 mil acre-ft development of other water sources is a necessity. To plan for the future need, several processes (desalinization, weather modifications, and water importation) are being investigated. To develop the importation idea, the Texas Water Plan was initiated in 1964. This paper describes the main aspects of the plan (water reuse, tapping the Mississippi River, control of irrigation) to help meet Texas' future needs. (Knapp-USGS)
W69-09882

OPTIMIZATION MODELS FOR RIVER BASIN WATER QUALITY MANAGEMENT AND WASTE TREATMENT PLANT DESIGN,
Weston (Roy F.), Inc., West Chester, Pa.
For primary bibliographic entry see Field 05G.
W69-10021

OPTIMUM WATER QUALITY MANAGEMENT OF STREAM AND ESTUARINE SYSTEMS,
Manhattan Coll., Bronx, N.Y. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05B.
W69-10024

AEROBIC TREATMENT OF RESIDUAL BREWERY WATERS, (FRENCH),
Ghent Rijksuniversiteit (Belgium). Inorganic Chemistry Lab.
F. M. Bosch, R. Roels, and L. Michiels.
La Trib du Cebedeau, Vol 22, No 305, p 183-185, Apr 1969. 3 p, 1 fig, 1 tab, 11 ref.

Descriptors: *Water pollution treatment, *Water pollution sources, *Industrial wastes, *Industrial water, *Aerobic treatment, Anaerobic conditions, Carbon dioxide, Acidity, Application equipment, Application methods, Water analysis, Carbohydrates, Calcium compounds, Nitrogen.
Identifiers: *Brewery wastes.

The use of an aerobic method to decrease water pollution by brewery wastes is discussed and a schematic sketch of the apparatus is given. The discussion includes the following: (1) preparatory steps; (2) supply and dosage; (3) measurements and analysis; (4) results; and (5) conclusion. The anaerobic phase destroys carbohydrates without forming a considerable amount of acids. In the next aerobic phase, the acids disappear, as well as a fraction of the nitrogen. At the end of the complete cycle the impurities are almost completely mineralized and can be considered as only slightly biopolluted. (Gabriel-USGS)
W69-10088

SIMULATION OF OXYGEN UTILIZATION IN STORAGE-TREATMENT PLANT SYSTEM,
Pennsylvania Dept. of Forests and Waters, Harrisburg; and Pittsburgh Univ., Pa.
Jan C. Phillips, Rafael G. Quimpo, and James P. Miller.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 661-670, 1968. 10 p, 2 fig, 2 tab, 10 ref.

Descriptors: *Waste water treatment, *Water quality control, *Analog models, Dissolved oxygen, Oxygen demand, Streamflow, Low-flow augmentation, Synthetic hydrology, Water management (Applied).
Identifiers: Streeter-Phelps equation.

Waste disposal has conventionally been approached by pre-treating raw waste such that then released into a watercourse during critical streamflow, minimum stream quality standards are not violated. An ideal treatment policy must allow for variations in streamflow and bio-chemical parameters during waste injection. A system consisting of a treatment plant allowing multiple-degree treatment, a synthesized streamflow sequence and storage elements capable of withholding treated effluent for optimal release is simulated in an analog computer. The system is operated for different concurrent values of parameters in the Streeter-Phelps oxygen utilization equation to determine the most efficient operating policy. Results were found to be representative of conditions in large stream of normal velocities. Problems of modeling and simulation are discussed. Refinements on the model are suggested. (Knapp-USGS)
W69-10128

AN ENGINEERING-ECONOMIC ANALYSIS OF SYSTEMS UTILIZING AQUIFER STORAGE FOR THE IRRIGATION OF PARKS AND GOLF COURSES WITH RECLAIMED WASTEWATER,
Nevada Univ., Reno. Coll. of Engineering.
For primary bibliographic entry see Field 03F.
W69-10187

WASTE WATER RECLAMATION, LOS ANGELES COUNTY,
Colorado Univ., Boulder.
John D. Parkhurst.
IN Water: Development, Utilization, Construction, 5th Western Resources Conference, Boulder, p 61-67, 1963.

Descriptors: *Water reuse, Waste water, Water quality, Financing, Reservoir sites.
Identifiers: *Los Angeles County.

In Los Angeles County, a comprehensive reclamation program could increase the availability supply of water for basin recharge and industrial use by approximately 25 per cent; in 1960 320,000 acre feet of wasted waterflow was a quality that was amendable to reclamation and re-use. The basic difference between sewage treatment and water reclamation is outlined - sewage treatment is seen as the responsibility of the community while water reclamation is viewed as a bonus to the community. Financing of water reclamation projects can be accomplished through accumulated tax funds, revenue bonds, general obligation bonds or purchase contracts. The technology for water reuse, however, is available and ready for present use. (Starr-Chicago)
W69-10197

RESEARCH AND DEVELOPMENT FOR REUSE OF WATER,
Colorado Univ., Boulder.
Perry L. McCarty.
IN Water: Development, Utilization, Construction, 5th Western Resources Conference, Boulder, Colo, 1963. p 55-59.

Descriptors: *Water reuse, *Research and development, Public health, Urbanization, Water quality, Water costs.
Identifiers: Reuse of water.

With an anticipated demand of nearly 600 billion gallons per day by 1980, it is expected that at least five of the nation's water resource areas will experience a water shortage. The reuse of water is seen as the answer to ameliorating this problem. While the method of increasing the cost of water could alter water use habits and improve the shortages, effective reuse is recommended as the more desirable method of solving the problem. Three conclusions reached: (1) improved methods of waste treatment using new chemical, physical or biological methods must be devised, with a concentration of research efforts aimed at developing these methods; (2) water quality standards should be compatible with health standards but not so restrictive as to limit the amount of reuse of water; and (3) the role of water resource personnel is seen as engaging in effective communication between researchers, water managers and public officials, and in attracting high-quality people into the field of water resource development. (Starr-Chicago)
W69-10198

ENVIRONMENTAL CONTROL FOR WATER RESOURCES IN OTTAWA COUNTY: PREFEASABILITY REPORT.
Bauer Engineering, Inc., Chicago, Ill.

Bauer Engineering, Inc., Chicago, Sept 1969. 63 p, 8 fig, 6 map, 15 tab, 4 ref.

Descriptors: *Waste water (Pollution), Sewage disposal, Sewage treatment, Programs, Geology, Human population, Urbanization, Animal populations, Land development, Municipal wastes, Industrial wastes.
Identifiers: *Waste water management, Ottawa County, Irrigation-disposal regions, Agricultural areas, Agricultural wastes.

The report suggests a program for Ottawa County, Michigan for collecting sewage, conveying it by pipeline, treating it and storing it, and then distributing the resultant effluent on agricultural land so that both water and nutrients are consumed by crops. Section I introduces two concepts basic to efficient waste water management: (1) wastes as resources out of place, and (2) the replacement of open-ended management systems with closed systems. Section II analyzes the environmental geology of Ottawa County in order to assess the feasibility of developing a plan to manage waste water. Generalized potential irrigation disposal regions are identified. Section III deals with development and population trends in the county in order to determine the extent of the waste problem. Discussion focuses on urban centers, urban sprawl, and agricultural development, including land holdings and animal populations. Section IV turns to waste problems, documenting the relative amounts of and problems associated with municipal, industrial and agricultural wastes. Section V evaluates the potential for waste water management. The section discusses management systems and management regions, and offers major findings and conclusions. Section VI outlines the next steps for program development. (Gossen-Chicago)
W69-10205

CHEMICAL TREATMENT OF OIL SLICKS, A Status Report on the Use of Chemicals and Other Materials to Treat Oil Spilled on Water.
Federal Water Pollution Control Administration, Edison, N. J. Water Quality Lab.

Available from the Clearinghouse as PB-185 947, $3.00 in paper copy, 0.65 in microfiche. Water Pollution Control Research Series Report, ORD-3, Mar 1969. 20 p. FWPCA Program No 15080.

Descriptors: Oil wastes, Oily water, *Water pollution treatment, Detergents.
Identifiers: Oil spills, *Oil spills-chemical tre
ment, *Dispersants, Sorbents, *Floating sorben
*Burning agents, *Sinking agents, *Gelling agen
Dispersant toxicity, Dispersant effectivene
chemical use, Effects.

The effectiveness and potential pollutional effe
of chemicals and other materials used to disper
sink, burn or otherwise dissipate oil slicks a
discussed. Agents considered are classed as: disp
sants, floating sorbents, sinking agents, gelli
agents and burning agents. Since many dispersan
are presently available, much experience has be
gained with the use of dispersants. Howev
dispersants should not be used indiscriminate
they may have deleterious effects on the ecology
is necessary to determine the toxicity and the effe
tiveness of dispersants viz-a-viz the same chara
teristics of the oil without dispersants. Practical e
perience with gelling, burning, floating and sinki
agents is limited. Some of the many commerc
products and natural materials used in connecti
with recent large oil spills are reported.
W69-10252

**JOINT MUNICIPAL AND SEMICHEMICA
PULPING WASTE TREATMENT, A Pilot Stu
Evaluating Combined Treatment of Domes
Sewage and Weak Semichemical Pulping a
Papermaking Wastes.**
Federal Water Pollution Control Administratio
Erie, Pa.; and Hammermill Paper Co., Erie, Pa.

Available from the Clearinghouse as PB-185 94
$3.00 in paper copy, 0.65 in microfiche. Water P
lution Control Research Series, Report ORD-1,
ref, 11 append, July, 1969. 138 p, 14 tab, 20 f
FWPCA Grant No. WPRD-223-01-68. Progra
No 11060 EOC.

Descriptors: Pilot plants, *Pulp wastes, Municip
wastes, *Sewage treatment, *Activated sludg
Sludge disposal, *Oxygenation, Disinfection, A
NUAL COSTS.
Identifiers: *Erie (Pa), Hammermill Paper Co
pany Laboratories, *Joint Treatment Plant.

The City of Erie, Pennsylvania and Hammerm
Paper Company made a study of the joint tre
ment of domestic sewage and pulp and paperma
ing wastes. A pilot plant was constructed a
operated in a series of controlled experiments. Su
plemental studies were conducted in the Hamm
mill laboratories including the operation of
bench-scale activated sludge plant. It was demo
strated that a joint treatment plant could effectiv
treat a mixture of domestic sewage and pulp a
paper mill wastes from Hammermill's Erie Di
sion. A full-scale joint treatment plant should o
tain a BOD removal of approximately 90%
summer months and 80%-85% in winter mont
Primary treatment should achieve a 25% reducti
in BOD and a 60% reduction in suspended solic
Treatment of mixed wastes by the activated slud
process will require a long solids aeration per
and a relatively low BOD to volatile solids loadi
to avoid high sludge volume indicies. The activat
sludge process does not reduce the color of t
mixed wastes and the final effluent will have abo
40 mg/1 of suspended solids. The chlorine dema
of the final effluent averaged over 60 mg/1.
NH3-Cl2 mixture added at a level of 2.61 pp
NH3 and 15-17 ppm Cl2 showed promise as dis
fectant with coliform counts generally bel
1,000/100 ml.
W69-10253

**STRAINER/FILTER TREATMENT OF CO
BINED SEWER OVERFLOWS,**
Federal Water Pollution Control Administratio
Washington, D.C.; and Fram Corp., Providen
R.I.
Stephen S. Blecharczyk, and Edward L. Shunney
Available from the Clearinghouse as PB 185 9
$3.00 in paper copy, 0.65 in microfiche. Water P
lution Control Research Series, Report WP-20-
July, 1969. 53 p, 26 tab, 6 fig, 14 ref, 1 appe

FWPCA Contract No. 14-12-17. Program No 1020 EXV.

Descriptors: Filtration, Sewage effluents, *Filters, Sewers, *Sewage treatment.
Identifiers: *Providence, Rhode Island, *Combined sewer overflows, *Strainers, Overflows, Sewer flow, Synthetic substrate.

The primary objective of this feasibility study was to evaluate the principle of a 'self-cleaning strainer, self-cleaning filter' concept for the treatment of combined sewer overflows. The anticipated goal was to design and construct a prototype system capable of handling up to 1000 gallons per minute with a B.O.D. reduction near 60 percent, and with the capability of automatic operation in remote locations. A combined sewer overflow in Providence, Rhode Island, was sampled and analyzed to determine the type and amount of contaminant discharged into the receiving stream. The average concentration was determined to be nearly equal to pure domestic sewage. It was also determined that the analysis reported for overflows is very dependent on the exact sampling method used. Automatic sampling devices utilizing small diameter tubing do not take a representative sample since the suspended solids distribution is not uniform over the cross-sectional area of the discharging stream. Based on overflow sample analysis data (samples taken manually), a synthetic substrate solution was prepared to evaluate a forced flow self-cleaning strainer for significant operating variables. The strainer and filter systems were evaluated using the synthetic substrate, primary influent to two separate municipal treatment plants, fresh sewage solids and actual combined sewer flow. It was demonstrated that the strainer model produced consistent suspended solids removal rates near 35 percent under highly varying load conditions, at a flux of 25 gallons per minute per square foot. The diatomite study showed operational success could be achieved at a 50 percent organic reduction rate at 4 gallons per minute per square foot of area, but at a minimum estimated operating cost of $1.50 per 1000 gallons.
W69-10254

POLYMERS FOR SEWER FLOW CONTROL, The Development and Demonstration of the Use of Polymers to Reduce or Eliminate Sewer Overflows by Flow Energy Reduction.
Federal Water Pollution Control Administration, Washington, D.C.
For primary bibliographic entry see Field 05C.
W69-10256

WATER POLLUTION AND WASTE CONTROL IN THE TEXTILE INDUSTRY,
F. Brannock.
Textile Forum Vol 25, p 10-13, Dec 1967-Jan 1968. 5 ref.

Descriptors: *Waste water treatment, *Waste disposal, Water pollution sources.
Identifiers: *Textile wastes.

The treatment and disposal of textile effluents in North Carolina are briefly surveyed under the following headings: Evaluation of the pollution problem: Sources and types of textile process wastes; Characteristics and effect of pollution; Determination of a course of action; and Reduction of wastes by in-plant process control. (Livengood-North Carolina)
W69-10257

KINETICS OF REMOVAL OF STARCH IN ACTIVATED SLUDGE SYSTEMS,
Illinois Univ., Urbana. Dept. of Civil Engineering.
S. Banerji, B. B. Ewing, R. S. Englebrecht, and J. E. Speece.
Water Pollution Control Fed, Vol 40, No 2, Part 1, p 161-173, Feb 1968.

Descriptors: *Activated sludge, *Kinetics, *Aerobic treatment, Aeration, Chemical oxygen demand, Temperature, Degredation (Decomposition), Microorganisms, Carbohydrates.
Identifiers: *Starch, Microbial degradation.

A laboratory-scale study of the kinetics of starch removal in activated sludge systems revealed that first-order kinetics prevail during the initial aeration period, with the removal-rate constant dependent on food-to-microorganism ratio rather than on initial sludge concentration. Removal of total chemical oxygen demand follows zero-order kinetics and depends on initial mixed liquor suspended solids. The effect of temperature on both removal rates is significant. In aerobic systems, further breakdown of starch breakdown products occurs inside microbial cells. Anaerobiosis has no effect on starch degradation under good mixing conditions, but greatly retards total-COD and total-carbohydrate removals. (Livengood-North Carolina)
W69-10258

BIODEGRADABLE SURFACTANTS FOR THE TEXTILE INDUSTRY,
K. A. Booman, J. Dupre, and E. S. Lashan.
American Dyestuff Reptr Vol 56, No 3, p P82-P88, 1967.

Descriptors: *Biodegredation, *Surfactants, *Test procedures, Sulfonates, Foaming, Microorganisms, Aerobic bacteria, Activated sludge, Standards.

Important biodegradability test methods are evaluated and the results obtained in these laboratory tests with various surfactants are reviewed. The degradability of linear alkyl aryl sulfonates has been studied extensively and tests developed. Where data are available field and laboratory results are correlated. (Goodwin and Livengood-North Carolina)
W69-10259

SURFACE-ACTIVE AGENTS IN TEXTILE PROCESSES AND THEIR EFFECT ON EFFLUENTS,
W. V. Barnes, and S. Dobson.
J Soc Dyers Colourists Vol 83, No 8, p 313-320, 1967.

Descriptors: *Surfactants, *Biodegredation, *Water pollution effects, *Soaps, Waste treatment, Detergents, Emulsifiers, Bactericides.
Identifiers: Textile processes (General), Alkyl benzene sulfonates, Nonionic surfactants, Cationic surfactants, Anionic surfactants, Antistatic agents, Dyeing auxiliaries, Man-made fiber production wastes, Molecular structure.

Various types of surface-active agents and their applications in textile processing are reviewed, particular consideration being given in the choice of a product for a specific application, to factors such as the biodegradability of the agent and its subsequent influence on effluents, waste treatment, and water pollution. (Goodwin and Livengood-North Carolina)
W69-10260

BIOLOGICAL TREATMENT OF TEXTILE EFFLUENTS,
Institute of Water Pollution Control, London (England).
A. I. Biggs.
Chemistry and Industry, No 37, Sept 16, 1967, p 1536-1538.

Descriptors: *Water supply, *Treatment facilities, Economics.
Identifiers: *Biological treatment, *Textile wastes.

A discussion is given of the treatment of wastes from the textile industry. A large number of factories were located to make use of available water supplies and in many cases are still distant from any large urban conurbation. To offset these difficulties the factories concerned have to undertake the very considerable cost of installing their own biol. treatment plant or become a major contributor to the capital cost of building a new sewage works. In the light of the present knowledge on the economics of biol. treatment the consequences to the textile industry are depressing. (Livengood-North Carolina)
W69-10261

VERSATILE ION EXCHANGE RESINS CAN SOLVE POLLUTION PROBLEMS.

American Textile Reptr Vol 80, No 9, p 12, 21, and 61, 1966.

Descriptors: *Water purification, *Hardness (Water), Waste water treatment, Treatment facilities, Surface waters, Standards, Corrosion, Flocculation, Iron, Magnesium, Calcium, Bicarbonates, Organic matter.
Identifiers: *Ion exchange resins, Textile wastes.

This paper reports on the treatment of raw textile waters using ion exchange resins. It considers economy of equipment installation in new or remodeled plants. (Goodwin and Livengood-North Carolina)
W69-10263

PURIFICATION OF INDUSTRIAL WASTES (IN GERMAN),
Erich Asendorf.
Chemiker-Ztg, Vol 90, No 16, p 573-578, 1966.

Descriptors: *Waste treatment, Hydrogen sulfide, Dairy industry, *Oil wastes, Phenols, Acids, Metals, Clays.
Identifiers: *Bisulfites, *Fiber wastes, *Textile wastes, Aldehydes, Acetonitrile, Acrylonitrile, Amines, Cyanides, Fluorine compounds, Starch.

Thumbnail descriptions of processes for the following wastes are given; aldehydes, acetonitrile, acrylonitrile, amines, bisulfite, H2S, HCN, chromic acid, tanning wastes, fibrous materials, F compounds, carbon dust, dairy wastes, oil and petroleum products, pharamaceuticals, phenols, starch manufg., acids, metal ions, textiles, clay, and sugar. (Livengood-North Carolina)
W69-10264

TREATMENT OF WOOL SCOUR EFFLUENT AND THE RECOVERY OF WOOL GREASE .

American Dyestuff Reptr, Vol 52, No 25, p P949, 1963.

Descriptors: Calcium chloride, *Chemical precipitation, *Soaps.
Identifiers: *Scouring waste, *Wool grease, *Recovery (Waste), Sodium carbonate.

The basis of the process used is the treatment of all the effluent with a solution of calcium chloride (brine) in a sufficient amount to precipitate the soap and sodium carbonate. This breaks the emulsion and the precipitated matter is filtered off by precoated rotary drum vacuum filters. (Livengood-North Carolina)
W69-10266

KNIT GOODS FINISHERS AND BIODEGRADABLE DETERGENTS,
R. H. Beaumont.
Knitting Ind, Vol 85, p 10, 39, 1965.

Descriptors: Biochemical oxygen demand, Detergents, Biodegredation, Treatment facilities, Legislation.
Identifiers: *Finishing wastes, Knitted fabrics, Alkyl benzene sulfoniates.

If waste goes through a treatment system, the new detergents are desirable; if not, it may be better to

keep biodegradability to a minimum. (Livengood-North Carolina)
W69-10267

WOOL SCOUR EFFLUENT TREATMENT AND WOOL GREASE RECOVERY.

Wool Record, Vol 106, p 24, 26, 1964.

Descriptors: Calcium chloride, Biochemical oxygen demand, Waste water treatment, Filtration.
Identifiers: *Scouring waste, *Wool, Wool grease, *Recovery (Waste), Chemical composition, Sulfuric acid.

Brief details are given of the use of calcium chloride to break down wool scouring wastes in a British plant. (Goodwin and Livengood-North Carolina)
W69-10268

BIOLOGICAL OXYGEN DEMAND (BOD) OF STARCH AND STARCH DERIVATES (IN DUTCH),
H. Benninga.
Tex, Vol 20, No 1, p 25-28, 1961.

Descriptors: *Biochemical oxygen demand.
Identifiers: *Starch, Starch ethers, Textile wastes chemical modification.

It is shown that the BOD of starch products in textile effluents depends to a great extent upon the degree of chemical modification to which the products were subjected. Etherification reduces the BOD of the starch derivatives. (Livengood-North Carolina)
W69-10269

WATER POLLUTION (IN FRENCH).

Lab Essais Chambre Comm Magamet, Vol 2, p 16-22, 1965.

Descriptors: *Effluent treatment.
Identifiers: *Wool, Decantation.

Results are reported from a simple installation of two decanting tanks for treating effluent in a Mazamet dewooling plant where water is supplied from a stream that is also the outlet for effluent. (Goodwin and Livengood-North Carolina)
W69-10270

A REVIEW OF THE LITERATURE OF 1964 ON WASTE WATER AND WATER POLLUTION CONTROL.

J Water Pollution Control Fed, Vol 37, p 587-646, 735-799, 887-979, 1965. 138 p.

Descriptors: *Waste water treatment, *Sewage treatment, *Analytical techniques, *Standards, *Legislation, Pollutants, Organic compounds, Pesticides, Phenols, Inorganic compounds, Nitrogenmpounds, Dissolved oxygen, Biological treatment, Filtration, Activated sludge, Disinfection, Detergents, Sludge digestion, Lagoons, Canneries, Dairy industry, Fermentation, Coal mine wastes, Oil wastes, Pulp wastes, Radioactive waste disposal, Radioactivity techniques, Bacteria, Biology, Radioactivity effects, Water supply, Groundwater, Microbiology, Biochemistry, Groundwater recharge, Sea water, Estuaries, Waste water disposal, Self-purification, Oxygen sag, Surface waters, Textile wastes.

The article discusses analytical methods; determination of organic carbon, pesticides, phenolic compounds, organic compounds, metals, inorganic anions, nitrogen compounds, and dissolved oxygen; laboratory control of sewage treatment; biological filtration; the activated-sludge process; disinfection of sewage and water; effects of synthetic detergents; sludge digestion; disposal and utilization of sludge; lagoons; re-use of sewage effluents; starch and sugar factories, chemical industries, and textile and wool industry; methods for treatment. of radioactive waste waters and recovery of radionuclides; removal of radioactivity from water and sewage; underground and marine disposal of radioactive wastes; uptake of radioactivity by bottom deposits and aquatic organisms; measurement of radioactivity and methods for continuous monitoring; biology of polluted waters; water quality requirements for fish; biological effects of pollution by sewage, detergents, industrial waste waters, and pesticides and weedkiller; algae, fungi, and bacteria in polluted waters; methods for biological estimation of pollution; effects of radioactive pollution; microbiology and chemistry of polluted waters; the oxygen sag and self-purification; use of stream standards; surveys of polluted waters; legislation and control of pollution; effects of pollution on water supplies; pollution of ground water and polluting effects of ground water recharge; pollution of estuaries and sea water; and disposal of waste waters at sea. (Livengood-North Carolina)
W69-10271

A REVIEW OF THE LITERATURE OF 1963 ON WASTE WATER AND WATER POLLUTION CONTROL.
J Wat Pollut Control Fed, Vol 36, p 535-572, 659-711, and 791-863, 1964. 164 p.

Descriptors: *Waste water treatment, *Sewage treatment, *Analytical techniques, *Standards, *Legislation, Pollutants, Metals, Nitrogen, Oxygen, Sulfur compounds, Disinfection, Activated sludge, Detergents, Degradation (Decomposition), Sludge digestion, Lagoons, Canneries, Coal mine wastes, Oil wastes, Dairy industry, Fermentation, Chemical wastes, Pulp wastes, Radioactive waste disposal, Biology, Microbiology, Oxygen sag, Self-Purification, Surface waters, Water supply, Water pollution control, Water pollution effects, Estuaries, Sea water.
Identifiers: Textile wastes.

The following topics are discussed: methods of analysis, including determination of metals, nitrogen, oxygen, BOD, organic compounds, sulphur compounds and suspended solids; laboratory control of sewage treatment; treatment of sewage by physical and chemical methods biological filtration, and activated-sludge process; disinfection of sewage; effects of detergents in water and sewage, and studies on degradation of detergents; sludge digestion; disposal and utilization of sludge; lagoons for sewage and waste waters; re-use of sewage-works effluents; treatment of waste waters from canneries, sugar refineries, dairies, meat packing, fermentation, pharmaceutical and chemical works, coal mining and processing, metal pickling, oil refineries, plating of metals, pulp and paper mills, tanneries and textile and wool industry; methods of treatment and disposal of radioactive wastes; biology of polluted water; biological indicators of pollution, microbiology of polluted waters; pollution by chemicals, oxygen sag and self-purification; stream standards; surveys of surface waters; legislation and control of pollution; effects of pollution on water supply; and pollution of estuarine and sea water. (Livengood-North Carolina)
W69-10272

EFFLUENT TREATMENT PLANTS: INSTALLATION AT SPINNING WORKS IN DEVON.

Water and Water Eng, Vol 68, p 115, 1964.

Descriptors: *Treatment facilities, Waste water treatment, Cracking, Autoclaves, Hydrogen ion concentration, Sewers.
Identifiers: *Scouring waste, *Wool, Steam heating, Wool grease, Effluent treatment.

The important design and operating features of the new plant installed to treat waste waters from the scouring of woollen yarn and cloth at the works of the Buckfast Spinning Company Ltd., Devon, are described. The waste waters are discharged to a holding tank where the pH value is adjusted and the emulsion is then pumped to an autoclave where it is subjected to steam heating, pressurizing, and cracking. The discharge from the autoclave is collected in another tank, the oils, fats and greases rising to the top and being decanted, stored, and eventually reprocessed. The pH value of the remaining liquor is adjusted before dilution with other waste waters and discharge to the municipal sewer. (Livengood-North Carolina)
W69-10273

EFFLUENT TREATMENT AT A YORKSHIRE MILL.

Textile Weekly, Vol 64, No 1, p 509-510, p 533 1964.

Descriptors: Economics.
Identifiers: *Fiber wastes, Effluent treatment.

The Flygt pumping installation described is said to be able to move water heavily laden with textile fibers and has been installed in Britain by a woolen and worsted manufacturer, dyer, and finisher. Installation and running costs were found to be low. In 18 months of operation it is claimed that no repair or servicing costs have occurred. (Livengood-North Carolina)
W69-10274

REMOVING DETERGENTS FROM WASTE WATERS: NEW LOW-COST METHODS.

Mod Textiles Mag, Vol 44, No 10, p 44, 1963.

Descriptors: *Ion exchange, Waste water treatment, Detergents.
Identifiers: *Recovery (Waste), Sodium hydroxide, Sulfuric acid.

A new 'liquid ion exchange' process developed by General Mills is described. Cook Machinery Company is to market the new system that makes possible the recovery of the reagent for continuous use. The principal chemicals consumed are sulfuric acid and sodium hydroxide. This system can be adapted to many areas where removal of contaminants in discharge water is important. (Livengood-North Carolina)
W69-10275

WATER AND WASTES SYSTEM FOR AN 'INSTANT FACTORY'.

Wat. Sewage Wks., Vol 111, p 186-190, 1964.

Descriptors: *Chemical wastes, Dams, *Industrial wastes, *Domestic wastes.
Identifiers: *Finishing wastes.

The new textile finishing plant of Pacolet Industries near Blacksburg, South Carolina, uses water from Buffalo Creek, a tributary of Broad River. A low diversion dam has been built at the intake point and water passes to a 1.5-ml gal. storage tank. Water for emergency supply is stored in an artificial lake enclosed by an earth dam, which receives storm drainage from the site. Caustic chemicals are recirculated and concentrated before treatment. Industrial and sanitary wastes are treated separetely in lagoons and effluent is discharged by a diffusing pipe to Broad River. (Livengood- North Carolina)
W69-10279

CHEMICAL PURIFICATION OF VARIOUS INDUSTRIAL WASTE WATERS (IN GERMAN),
Willi Ballnus.
Wasser Luft Betr., Vol 8, p 201-204, 1964.

Descriptors: *Waste water treatment, *Cost comparisons, Pulp wastes, Water purification, Sulfates, Iron compounds, Calcium hydroxide.
Identifiers: *Textile wastes, Aluminum compounds, Silicone compounds.

Pptn. processes are described for the treatment of waste water from a paper and ceramic-producing industry and a textile plant. Good purification was obtained in the 1st case with A12 (SO4) 3 and activated SiO 2. Usable results were obtained with FeSO4 in combination with Ca (OH) 2 and with A12 (SO4)3 in the treatment of textile waste water. A so-called 'waste water purification sulfate' gave the same results as A12 (SO4) 3 but the usefulness of this product has not been completely tested. Costs of chemicals for the individual pptn. processes are given. (Livengood-North Carolina)
W69-10280

WASTE-TREATMENT EXPERIENCE REPORTED,
J. L. Brown.
Southern Power and Ind., Vol 79, No 1, p 18-20, 44, 1961.

Descriptors: *Biochemical Oxygen Demand, Domestic wastes, Treatment facilities, Hydrogen ion concentration separation techniques, Filtration, Digestion.
Identifiers: *Starch, *Sodium hydroide, *Textile wastes, *Desizing wastes.

For treatment of a textile-mill effluent, existing methods were too expensive and didn't solve the problem. The main industrial contaminants were starch and other components from the desizing operation, and a 3% NaOH solution from the cleaning operation. Other plant effluents contributed little to the contamination. A biological purification system was already in use on the domestic sewage from the plant. It was found desirable to take the effluents from the desizing operation and the alkaline liquors separate to the treatment plant. Much of the starch was separated out in the primary clarifier, domestic sewage was treated in a similar unit, and the two effluents were mixed. The wash effluent was stored for about a week in large tanks, and then allowed to flow at a regular rate into the domestic sewage so as to give a pH of 11.4. It was not desirable to add this alkaline solution directly into the starch waste, as some of the starch was converted into solvent form. The effluent from the clarifier was then treated in 1st and 2nd stage filters. Separate digesters are provided for the sludge from the primary and secondary filters. Digestion of the primary filter sludge is very rapid owing to the high starch content. This plant removes 96-98% of the settleable solids; the BOD of approximately 1400-1600 was reduced by 81.2% in January and 98.3% in August. (Livengood-North Carolina)
W69-10281

WASTE TREATMENT AT CANNON MILLS,
J. L. Brown.
Textile Inds., Vol 124, No 6, p 78-81, 1960.

Descriptors: *Domestic waste, *Biological treatment, Waste water disposal, Treatment facilities, Alkalinity, Biochemical oxygen demand, Waste treatment, Legislation, Standards.
Identifiers: *Desizing wastes, *Bleaching wastes, *Starch, *Sodium hydroxide, Textile wastes, Peroxide bleaches.

The disposal of domestic sewage from the mills and mill village, as well as certain textile processing wastes from the wet processing plant and slasher rooms, is described. (Goodwin and Livengood-North Carolina)
W69-10282

BLEACHERY AND DYEHOUSE WASTE STUDIES,
J. L. Brown, Jr.
American Dyestuff Reptr. Vol 44, p 385-386, 1955.

Descriptors: Economics, *Biological treatment, Separation techniques, *Domestic wastes.
Identifiers: *Bleaching wastes, *Dyeing wastes.

A two-year study of the waste produced in the bleachery and dyehouse has been completed. Pilot plant operation is planned to determine the most economical treatment and design factors for construction purposes. The principles involved, based on analysis of the lab studies, will be: (1) Segregation of the waste into 3 components; (2) storage of 2 of these components; (3) blending of the 3 components and domestic sewage in proportions that are suitable for biological treatment. The results of the two year study and theoretical pilot-plant operation are discussed. (Livengood-North Carolina)
W69-10283

DETERMINATION OF THE DEGRADABILITY OF SYNTHETIC DETERGENTS,
E. L. Barnhart.
Water Wastes Eng, Vol 34, p 646-648, 1963.

Descriptors: *Biodegredation, *Detergents, *Activated sludge, Test procedures, Treatment facilities, Statistics, Biochemical oxygen demand, Chemical oxygen demand, Alkyl benzene sulfonate.

Sufficient laboratory tests can be performed to define the degradability of synthetic detergents. These tests may be used to determine the overall effect of the syndets on the treatment plants and the receiving streams. From such studies statistical data can be obtained and interpolation to a wide range of conditions is possible. (Goodwin and Livengood-North Carolina)
W69-10285

CMC KAYOED STREAM POLLUTION.
Textile Ind., Vol 124, No 10, p 161-162, 1960.

Descriptors: *Biochemical oxygen demand, Cotton, Standards, Temperature, Flow rates.
Identifiers: *Desizing wastes, *Starch, *Carboxymethylcellulose, Slashing.

At the Dan River Mills, Inc., Virginia, 50-60% of the pollution load discharged to the Dan River resulted from the cotton desizing wastes and particularly during the summer with low flows and high water temperatures, the oxygen concentration in the river was reduced below state standards. Experiments showed that the BOD of the waste waters could be reduced by using CMC instead of starch in the sizing process, and this has now been used in full-scale operation for over a year. (Livengood-North Carolina)
W69-10287

DISPOSAL OF COMBINED TEXTILE FINISHING WASTES AND DOMESTIC SEWAGE,
G. G. Bogren.
American Dyestuff Reptr. Vol 47, p 473-476, 1958.

Descriptors: *Cotton, *Biochemical oxygen demand, Hydrogen ion concentration, Domestic wastes, Trickling filters.
Identifiers: *Finishing wastes.

Five years experience at Sayles Finishing Plants indicates that cotton-finishing wastes having a pH in excess of 10.5 may be treated on trickling filters with a small admixture of domestic sewage, with BOD reductions averaging 50 to 60 per cent. Neutralization of wastes will enable the same trickling filters to reduce BOD 60 to 80 per cent. Mixtures of cotton finishing wastes with a small percentage of domestic sewage. (Livengood-North Carolina)
W69-10288

BLEACHERY WASTES TREATED BY NUTRIENTS AND HIGH-RATE FILTER PLANT.

Wastes Eng., Vol 26 p 452-453, 1955.

Descriptors: *Treatment facilities, Sedimantation, Lagoons, *Aeration, *Biological treatment, Filtration, Sludge, Cotton, Alkalinity, Acidity, Nitrogen, Phosphorus.
Identifiers: *Bleaching wastes, *Finishing wastes.

A treatment plant was constructed in 1948 at Mansfield Bleachery, Mansfield, Massachusetts, to provide treatment for the general mill wastes and the alkaline and acid process wastes that are discharged from the cotton-finishing mill. The plant is designed to treat a maximum flow of 1 mgd by primary sedimentation, aeration, high-rate bilogical filtration and second sedimentation, recirculated to the aeration tank. The final effluent can be discharged to the river, or stored in a lagoon from which it seeps into the ground. It is necessary to add supplementary N and P to the waste waters. Sludge is disposed of in a lagoon. (Livengood-North Carolina)
W69-10289

WASTES TREATMENT PLANT FOR COTTON FINISHING INDUSTRY, SAYLESVILLE RHODE ISLAND.

Wastes Eng. Vol 26 p 297, 414, 1955.

Descriptors: *Treatment facilities, *Waste water treatment, Cotton, Sedimentation, Sludge.
Identifiers: Percolating filters, Finishing wastes.

The plant for treatment of the waste waters at a mill of the Sayles Finishing Plant, Inc. at Saylesville, Rhode Island, has recently been greatly enlarged to treat more adequately the heavy mill wastes. High-rate percolating filters now supplement the original low-rate percolating filters. The extended plant consists of primary sedimantation tanks; low-rate percoalting filters, cinder filters and high-rate percolating filters; secondary sedimentation tanks; and sludge-drying beds. Maximum capacity is 3.3 m.g.d. (Livengood-North Carolina)
W69-10290

OXYGENATION OF IRON (II) IN CONTINUOUS REACTORS,
North Carolina Water Resources Research Inst., Raleigh.
Charles R. O'Melia.
Water Resources Research Institute Report No. 23, 1969. 53 p, 6 tab, 9 fig, 20 ref. OWRR Project A-022-NC.

Descriptors: *Water quality control, *Water treatment, *Water chemistry.
Identifiers: *Iron oxidation, *Chemical reaction engineering, *Optimization.

The research presented in this report is a case history of the application of principles of chemistry, chemical reaction engineering, and optimization to a problem of interest and concern in water quality control, viz, the oxygenation of ferrous iron by oxygen. Theoretical concepts used in attacking the problem are presented, together with experimental results obtained in laboratory scale continuous stirred-tank reactors. Comparison between theoretical predictions and experimental results is shown to be very good. Implications of the theoretical model in the setting of design standards are discussed.
W69-10293

5E. Ultimate Disposal of Wastes

MONTE CARLO SIMULATION OF WASTE DISCHARGE,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 05B.
W69-09880

5F. Water Treatment and Quality Alteration

TESTING OF WATER SUPPLIES.
For primary bibliographic entry see Field 06E.
W69-10040

PSEUDOMONAS AERUGINOSA FOR THE EVALUATION OF SWIMMING POOL CHLORINATION AND ALGICIDES,
Wisconsin Univ., Madison. Water Chemistry Lab.
G. P. Fitzgerald, and M. E. DerVartanian.
Applied Microbiology, Vol 17, No 3, p 415-421, March 1969. 1 fig, 4 tab, 19 ref.

Descriptors: *Pseudomonas, *Swimming pools, *Bacteria, *Bactericides, *Chlorination, *Aquatic bacteria, *Aquatic microbiology, Algicides, Bioassay, Disinfection, Environmental effects, Environmental sanitation, Inhibition, Chlorine, Nitrogen compounds, Sewage, Sewage bacteria, Sewage treatment, Water pollution, Water pollution effects, Algal control, Analytical techniques, Aquatic algae.
Identifiers: Pseudomonas aeruginosa.

Concentrations of ammonia and the chlorine stabilizer, cyanuric acid, which could be expected in swimming pools, decreased the rate of kill by chlorine (C1)of the potential pathogen, Pseudomonas aeruginosa. The effect of cyanuric acid increased as the concentration of C1 decreased, a fact of significance from a public health view. Quaternary ammonium algicides had little effect on the kill rate of C1, but an organic mercury algicide had a synergistic effect with C1 when C1-activity was stressed by the addition of ammonia or the use of 100 times the normal concentration of bacteria. The effect of natural waters, rain, beaches, and swimming pools on the kill rate of 0.5 milligrams C1/liter indicated that a treatment time of one hour or more was required to kill 99.9% of Pseudomonas cells at concentration of a million cells per liter. The synergism of C1 and the organic mercury algicide was also demonstrated with these waters and with sewage treatment plant effluents. Author discusses the necessity of developing and using laboratory tests which simulate conditions in swimming pools with heavy loads of swimmers, as opposed to tests in chlorine demand-free conditions. (Fitzgerald-Wis)
W69-10171

SANITARY PROVISIONS.

SC Code Ann secs 35-121 thru 35-124 (1962).

Descriptors: *South Carolina, *Water pollution, *Public health, *Sanitary engineering, Sewage disposal, Wastes, Water purification, Legislation, Legal aspects, Water policy, Administrative agencies, Water supply, Diseases, Environmental sanitation, Portable water, Water quality, Water analysis, Water resources, Water quality control.

Only where towns have no public waterworks system will privies be allowed and then only as approved by the State Board of Health. Water used by hotels or restaurants, when there is no public water supply, must be analyzed by the Board at least twice a year. Cisterns and other receptacles containing standing water must be screened or covered so as to prevent the entrance of flies, mosquitoes, and other disease-carrying insects. (Johnson-Florida)
W69-10300

5G. Water Quality Control

CHEMISTRY OF N AND MN IN COX HOLLOW LAKE,
Florida Univ., Gainesville.
For primary bibliographic entry see Field 05A.
W69-09881

ARTIFICIAL DESTRATIFICATION IN RESERVOIRS OF THE CALIFORNIA STATE WATER PROJECT,
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 05C.
W69-09883

DISTRIBUTION OF PESTICIDES IN SURFACE WATERS,
Virginia Polytechnic Inst., Blacksburg, Va.
For primary bibliographic entry see Field 05B.
W69-09884

WATER QUALITY AND FLOW OF STREAMS IN SOUTHEASTERN WISCONSIN,
Southeastern Wisconsin Regional Planning Commission, Waukesha.
Roy W. Ryling.
Southeastern Wis Reg Planning Comm Tech Rep No 4, Nov 1966. 342 p, 66 fig, 17 map, 299 tab, 36 ref.

Descriptors: *Water quality, *Wisconsin, *Data collections, *Water pollution sources, *Land use, *Urbanization, Water chemistry, Water pollution effects, Municipal wastes, Sewage treatment, Planning, Water management (Applied), Water resources development, Regional analysis.
Identifiers: Milwaukee, Southeastern Wisconsin urbanization, Regional planning.

A study of stream water quality in the Southeastern Wisconsin Region was made as part of an intensive effort to adjust regional land use and transportation system development plans to the underlying and sustaining natural resource base. An attempt was made to relate stream water quality to land use development and to forecast such water quality under alternative land use development patterns. Stream water quality data collected in the study are tabulated, present stream water quality within the Region is related to existing major sources of pollution, the effect of stream water quality on various water uses is assessed, and the interrelationships between stream water quality and land use patterns are studied. Tables and water quality graphs present the factual and interpretive data. Forecasts of future stream water quality within the major watersheds of the Region are presented for alternative land use development plans. The assumptions and rationale underlying these forecasts should prove of assistance in anticipating future stream water quality conditions within the Region. Perhaps the most important finding is the close relationship between land use and stream pollution within the Region and the need to plan future land use and water quality control elements simultaneously. (Knapp-USGS)
W69-09947

THE RANGE OF CHOICE IN WATER MANAGEMENT,
Resources for the Future, Inc., Washington, D.C.
Robert K. Davis.
Baltimore, Maryland, Johns Hopkins Press. 196 p. 1968.

Descriptors: *Dissolved oxygen, *Water quality, Streamflow, Waste treatment, Sewage, Recreation, Reservoirs, Lowflow augmentation, Effluents, Construction, Coagulation, Chemical precipitation, Biological properties, Cost-benefit analysis, Aeration, Input-output analysis, Waste level, Estuaries, Economic feasibility, Flood control, Costs, Political aspects.
Identifiers: *Microstraining, Waste management cost function.

This study dissects a federal study of the Potomac basin and assesses in detail the range of choice for dealing with a major subproblem in the basin, namely that of maintaining suitable levels of dissolved oxygen in the Potomac estuary. It is a detailed study of the engineering and economics of dissolved oxygen in the Potomac estuary. The author attempts to discover how broad an array of alternative courses of action may be technologically possible in a given water quality management program. He also wishes to study the analytic problems which the study of alternatives presents to water resource planners. The obstacles that the institutional or procedural forms of water resource planning present to limit the range of alternatives considered by planners are presented. Finally, the author wishes to use this approach to discern what kind of responsibility must be exercised by political leaders if planners are to be encouraged to explore the range of choice and if the information so developed is to be utilized effectively in policy and program formulation. (Murphy-Rutgers)
W69-09964

COMMENT ON ECONOMY OF WATER QUALITY MANAGEMENT AND POLLUTION CONTROL,
Vulcan Materials Co., Birmingham, Ala.
J. E. Wood, III.
In The Fresh Water of New York State: Its Conservation and Use, p 62-64, Wm C Brown Book Co, Dubuque, Iowa, 1967. 3 p. Edited by Hitchcock, Lauren B.

Descriptors: *Water pollution, Water pollution control, Pollution abatement, Costs, Regulation, Conservation, Water quality control, Water management.
Identifiers: *Effluent charges.

The author agrees with the paper being commented on in respect to the immensity of the water pollution problem, both present and future and that, aside from all aesthetic considerations, there are compelling economic justifications for water pollution control and abatement. However, the author questions the propriety of the proposed system of 'effluent charges' to be imposed by the government and paid to governments by polluters. The principal argument against such charges is that if the charge is sufficiently modest to be tolerable, it becomes a purchased license to pollute. On the other hand, if it is set high enough to effectively prevent pollution, it becomes punitive in nature and a poor substitute for direct regulation. It is also argued that the complexity of administration of a system of effluent charges is too great to be practical. (Loeb-Rutgers)
W69-09965

WATER QUALITY CRITERIA.
American Society for Testing and Materials, Philadelphia, Pa.

American Society for Testing and Materials, Philadelphia, Pennsylvania, 1967. 121 p.

Descriptors: *Water quality, Industrial use, Municipal water, Water pollution, Water pollution control, Water utilization, Water supply, Irrigation, Aquatic life.
Identifiers: *Water quality criteria, Agricultural use, Recreational use, Estuarine organisms, Stream quality, Pacific Oyster Embryo Bioassay.

The papers in this volume were presented at the first ASTM National Meeting on Water Quality Criteria held in Philadelphia in September 1966. Federal Water Pollution Control legislation enacted in 1965 requires that the States establish water quality criteria and provide for implementation of quality controls based upon such criteria. These criteria should rely on scientific fact if the public interest is to be served by this legislative directive. The purpose of the papers presented at this meeting was to evaluate the present state of scientific knowledge of quality requirements for water to be used in agriculture, for municipal and industrial supplies, and for recreation. The papers point out both the adequacies and inadequacies of knowledge in the field. Needs for sound scientific data are discussed and of particular interest is the

emphasis on the requirements of adequately accurate, precise, and standardized methods of analysis. (Loeb-Rutgers)
W69-09967

STANTON V TRUSTEES OF ST JOSEPH'S COLLEGE (RESPECTIVE RIGHTS OF UPSTREAM AND DOWNSTREAM RIPARIAN OWNERS WHEN UPSTREAM USE IS TO BE NON-RIPARIAN).

254 A2d 597-601 (Me 1969).

Descriptors: *Maine, *Relative rights, *Riparian rights, *Reasonable use, Legal aspects, Sewage, Easements, Water quality, Streams, Colleges, Judicial decisions.
Identifiers: *Non-riparian uses, Injunctions (Prohibitory).

Defendant college is an upstream riparian owner of a lot on a non-navigable stream. The college itself is located on non-riparian property. Defendant planned to pump sewage from the college to the lot for discharge into the stream. Plaintiffs downstream riparian owners sought to enjoin the commencement of the sewage discharge. The court found that plaintiffs had certain rights to the waters of the stream unchanged in quantity and quality. However, plaintiffs' rights were subject to the reasonable riparian uses of other riparian owners. The planned discharge of sewage by defendant was not a riparian use because the stream was not 'subservient' to the land on which the college is located. The reasonable use doctrine cannot be asserted against riparian owners by other riparian owners who plan to use their riparian land for non-riparian purposes. Defendant was not entitled to a non-riparian use which would change the quantity and quality of the water. The injunction was granted. (Keith-Fla)
W69-09968

OPTIMIZATION MODELS FOR RIVER BASIN WATER QUALITY MANAGEMENT AND WASTE TREATMENT PLANT DESIGN,
Weston (Roy F.), Inc., West Chester, Pa.
Chia Shun Shih, and John A. DeFilippi.
Proc, Fourth Amer Water Resource Conf, N Y, p 754-779, Nov 1968. 26 p, 7 fig, 12 tab, 9 ref.

Descriptors: *Optimization, *River basins, *Water quality control, *Waste treatment, *Dynamic programming, *Design criteria, Mathematical models, Industrial wastes, Municipal wastes, Cost-benefit analysis, Water management (Applied).

Mathematical models which described the interdependency of systems components were used to optimize the overall economic return from water quality management in a river basin. The objective of the study was to present an optimization model which considered the total cost to water users and waste dischargers in a basin, and to identify direct benefits in terms of reduced treatment costs. Two dynamic programming models were presented. The first was a water quality management model that minimized the total costs of both water and waste treatment in the river basin. The second model designed for optimum waste treatment plant design could add an extra cost-saving refinement to the first model. It was felt that better water quality management could be achieved by using first model. The waste treatment plant design model could also be applied independently for normal industrial and municipal waste treatment design problems. (Thiuri-Cornell)
W69-10021

WATER SUPPLY, DRAINAGE AND FLOOD CONTROL.
For primary bibliographic entry see Field 06E.
W69-10057

POLLUTION OF STREAMS.
Ark Stat Ann secs 47-801 thru 47-813 (1964).

Descriptors: *Arkansas, *Water pollution, *Administrative agencies, State governments, Water pollution control, Wastes, Waste disposal, Corporations, Permits, Legislation, Public health, Investigations, Surveys, Pollutant identification, Regulation, Standards, Water quality, Sewage disposal.

The Arkansas Game and Fish Commission, in order to prevent pollution, shall have control of waste disposal. The Commission shall promulgate rules, conduct investigations, and establish pollution standards. It is unlawful for any person, municipality, industry, or corporation to discharge waste into any waters so as to endanger public health, fish, or wildlife. The Commission may order such conduct stopped after a hearing. A Water Pollution Control Commission is established within the state Board of Health and is empowered to: enforce the pollution laws; conduct hearings, investigations, and surveys; establish standards; prepare a program to reduce pollution; issue orders regarding pollution; and plan disposal systems. The Commission may cooperate with any other state governments or the United States Government in matters of water pollution. An act which may cause pollution must be submitted to the Commission, and a permit issued before it may be undertaken. The residents of any area may petition the Commission to investigate alleged pollution. (Darragh-Fla)
W69-10071

PROTECTION OF SMALL RIVERS UNDER INTENSIVE USE, TAKING THE MOSKVA RIVER AS AN EXAMPLE,
Akademiya Nauk SSSR, Moscow. Institut Biologii Vnutrennykh Vod.
For primary bibliographic entry see Field 05C.
W69-10139

COPPER SULPHATE AIR SPRAY CURES LAKE ALGAE PROBLEM,
Sewer and Water Engineer, Sudbury (Ontario).
D. D. Brouse.
Water and Pollution Control, Vol 104, No 4, p 25-27, Apr 1966. 4 fig.

Descriptors: *Copper sulfate, *Algal control, Water supply, Water quality, Water pollution control, Nuisance algae, Taste, Odor.
Identifiers: *Air spray, Sudbury (Ontario), Lake Ramsey (Ontario), Algae counts, Threshold odor numbers, Crop-dusting aircraft, Water sampling, Ontario Water Resources Commission, Pest Control Organization of Toronto, Filamentous algae, Navicula, Aphanizomenon, Ontario (Canada).

Since 1960, Sudbury, Ontario, bordering Lake Ramsey, has twice experienced severe taste and odor problems in its municipal water supply. Lake Ramsey has a surface area of 2,023 acres, depths to 65 feet, and little outflow. In October 1965, the algae count peaked at 33,400 areal standard units, Aphanizomenon predominating, accompanied by a threshold odor number of 200. Aphanizomenon's ability to withstand winter temperatures necessitated immediate action. On November 6-8, crop-dusting aircraft sprayed 20 tons of copper sulfate over the lake surface resulting in copper content of 0.20 parts per million (ppm). The immediate area of municipal water intake was avoided. By November 14th, the algae count had been reduced to 2,500 and the odor number to 24. On Novenber 22nd, the algae count had rebounded to 5,000 and odor number to 140, while the copper concentration remained 0.20 ppm. In late November, a second treatment brought the maximum average copper concentration to 0.36 ppm. One week later, after freezing over, the lake's algae count was back down to 2,000 and the odor number to 17. By the end of December, the water was satisfactory for municipal use with only slight noticeable odor (algae count: 1,300, odor number: 4). (Ketelle-Wis)
W69-10155

CHANGES IN WESTERN LAKE ERIE DURING THE PERIOD 1948-1962,
Bowling Green State Univ., Ohio.
For primary bibliographic entry see Field 02H.
W69-10156

ALGAE CONTROL WITH COPPER SULFATE,
Portland Water District, Maine.
W. D. Monie.
Water and Sewage Works, Vol 103, p 392-397, Sept 1956. 7 fig, 8 ref.

Descriptors: *Algal control, *Copper sulfate, Water supply, Reservoirs, Water quality, New Jersey, Temperature, Organic matter, Hardness, Carbon dioxide, Fish.
Identifiers: *Microscopic examination, *Critical temperatures, *Copper dosage, *Copper application methods, Algae identification, Algae counts, Algal growth, Sedgwick-Rafter Method, Treatment timing, Algae control requirements, Threshold odor tests, Asterionella, Aphanizomenon, Synura, Anabaena, Melosira, Mallomonas, Ulothrix, David Monie Test, Summit (NJ), Canoe Brook Reservoir (NJ).

Algal control should be practiced as a preventative measure and not a cure. The important factors of control with copper sulfate are: (1) ability to determine when treatment is necessary, (2) correct dosage of copper sulfate, (3) application aimed for uniform distribution. The first step is algae identification and counting through microscopic analysis, commonly using the Sedgwick-Rafter Method. Water temperature data are useful in revealing critical temperature ranges in which growth of various species is stimulated. Monitoring temperature allows anticipation of period of rapid algal growth and species composition. Timing of treatment and dosage are important considerations, partially dependent on chemical characteristics of water, temperature, and type of organisms. No fixed dosage can be prescribed, but seven factors may be used as guidelines: algal species, amount of organic matter, water hardness, carbonic acid content, temperature, fish species, and total volume to be treated. A simple, practical laboratory test (David Monie Test), developed by the author for determining correct copper sulfate dosage without regard to water temperature and composition and--within limits--the type and amount of organisms present, is described. Finally, bottom topography is critical in determining dosages for achieving equitable distribution. (Ketelle-Wis)
W69-10157

REMOVAL OF ORTHOPHOSPHATES FROM AQUEOUS SOLUTIONS WITH ACTIVATED ALUMINA,
Northwestern Univ., Evanston, Ill. Dept. of Chemical Engineering.
Ronald D. Neufeld, and George Thodos.
Environmental Science and Technology, Vol 3, No 7, p 661-667, July 1969. 7 fig, 2 tab, 19 ref.

Descriptors: *Phosphorus compounds, Eutrophication, Nitrates, Ion exchange, Water pollution control, Waste water treatment, Nutrients, Analytical techniques, Adsorption, Water chemistry, Sorption, Hydrogen ion concentration.
Identifiers: *Orthophosphates, *Chemical processes, *Activated alumina, Alumina, Surface chemistry, Colloidal chemistry, Langmuir isotherm, Probability plot.

Authors cite evidence that some biological treatments for reduction of phosphates in waste water treatment, involving the use of activated sludge or algal removal in a controlled environment, do not fulfill rigid requirements for tertiary treatment. Utilizing laboratory-scale fixed beds of activated alumina ranging from 1.97 to 26.0 centimeters in height, they effected removals in excess of 99.9% orthophosphates from aqueous solutions. Initial concentrations of phosphate-ion in feed varied from 10 to 120 milligrams/liter. Experimental evidence indicates that exchange with nitrates present on solid alumina accompanies initial removal of orthophosphates followed by consecutive reaction of phosphate on surface with that in solution to effect further removal. Utilizing

parameters empirically determined from their short-bed (1.97 centimeters) experiments, and from breakthrough curves for bed thicknesses of 3.5 centimeters in their long-bed experiments, authors established the relationship: q= 3.745 c/(1+ 0.0787 c), where q is equilibrium capacity of alumina in milligrams phosphate-ion/gram alumina, and c is initial feed concentration of phosphate-ion (conditions: temperature, 71 deg F; c equal to or less than 120 milligrams phosphate-ion/liter). This relationship agrees well with q=9 for c=5 reported by Yee (1966, J Am Water Works Association, 58:239). (Eichhorn-Wis)
W69-10176

ECONOMIC EVALUATION OF FLOW AUGMENTATION: A SYSTEMS ANALYSIS CASE STUDY,
Northwestern Univ., Evanston. Dept. of Civil Engineering.
Jerry R. Rogers, and Robert S. Gemmell.
Proc 21st Industrial Waste Conference, Purdue University, Lafayette, Ind., May 1966. 19 p, 1 fig, 6 tab, 5 ref.

Descriptors: *Linear programming, *Dissolved oxygen, *Biochemical oxygen demand, *Flow augmentation, *System analysis, Water quality control, Flow.
Identifiers: *Regional waste treatment, Sensitivity analysis, Deoxygenation coefficient.

The 112-mile section of the Fox River below the Chain of Lakes to the confluence with the Illinois River was divided into 46 river sections. There were 24 waste discharges; 16 locks and low dams; and 8 tributaries at the river sections. A case study (of the linear programming procedure developed by Deininger) was successful in minimizing the total cost of regional waste treatment while maintaining pre-set stream quality standards of DO and/or BOD. Lemke's dual simplex procedure and the Thomas step method for DO prediction were incorporated in the systems analysis. Flow augmentation of stored flood waters in Lake Michigan was tested with water quality for various periods of low flow analysis. A sensitivity analysis of the deoxygenation coefficient and the degree of treatment was conducted. The digital computer program is applicable to river basin quality planning and population growth. (Grossman-Rutgers)
W69-10190

DEPOSIT OF SAWMILL WASTE IN WATERS.

Vt Stat Ann Tit 10, sec 951 (Supp 1968).

Descriptors: *Vermont, *Water pollution sources, *Saw mills, *Sawdust, Legislation, Lightweight aggregates, Woodwastes, Mills, Structures, Industrial wastes, Lumber, Pulp and paper industry, Pulp wastes, Water pollution, Banks, High water mark, Legal aspects.
Identifiers: Sawmill refuse.

It shall be unlawful for a person to deposit any sawmill refuse in the waters of any stream or watercourse or on the banks thereof in such a manner as to be washed into the main stream under normal high water conditions. Violators shall be subject to a fine for each offense. (Helwig-Fla)
W69-10222

REUTER V DEPT OF NATURAL RESOURCES (ADMINISTRATIVE FINDING OF EFFECTS UPON WATER POLLUTION AS PREREQUISITE TO ISSUANCE OF DREDGING PERMITS).

168 NW 2d 860-863 (Wis 1969).

Descriptors: *Wisconsin, *Administrative agencies, *Water pollution control, *Permits, Water pollution sources, Dredging, Excavation, Public rights, Public health, Legislation, Judicial decisions, Appeals, Water pollution effects, Bogs, Lake beds, Investigations, Regulation, Water utilization.
Identifiers: Administrative preferences.

Pursuant to statutory enactment, the Department of Natural Resources was given authority to issue permits for the removal of material from the beds of lakes. Legislation creating the Department declared that its purpose was to enhance water quality through regulations and by the giving of preferences to uses not tending to pollute water or tending to minimize pollution. The plaintiffs brought an action for review of a department order granting a permit to dredge a certain 2 acre floating bog. Plaintiffs contended that the preponderating factor in granting the permits was the effect upon water pollution. The trial court upheld the department order. On appeal, the supreme court of Wisconsin held that the statutes required the department to make a specific finding of the effect upon water pollution in any ruling on a petition for a permit. After such a finding, the department could weigh that factor among others considered. The court further held that a mere finding that issuance of a permit was in the 'public interest' was not sufficient. (Harris-Florida)
W69-10242

WATER SUPPLY.

Ind Ann Stat secs 35-2901, 35-2902, 35-2908, 35-2909 (1969).

Descriptors: *Indiana, *Water supply, *Pollution abatement, *Water pollution control, Legislation, Sewage treatment, Sewage effluents, Public benefits, Water utilization, Damages, Remedies, Agriculture, Industries, Operations, State governments, Public health, Legal aspects, Effluents, Administrative agencies.

No person shall deposit into the waters of the state any substance which (1) is deleterious to the public health or to the lawful use of the water by any industry or lawful occupation; (2) adversely affects any agricultural pursuit; (3) lessens or impairs any livestock industry or the use of the water for domestic animals; (4) lessens or impairs or materially interferes with the use of the water by the state or any political subdivision; or (5) destroys or jeopardizes any beneficial animal, fish, or vegetable life in the water. Any person who has suffered or is threatened with damage because of water pollution may bring suit to abate the pollution. Whenever any sewage treatment plant is not producing pure effluent and has made any public water supply impure, the state board may order the offender to appoint a competent person to superintend the operation of the sewage plant. The provisions of this division and the laws relating to pollution of waters and public water supply shall be enforced by the state pollution control board. (Heckerling-Florida)
W69-10246

IMPROVED SEALANTS FOR INFILTRATION CONTROL, The Development and Demonstration of Materials to Reduce or Eliminate Water Infiltration Into Sewage.
Federal Water Pollution Control Administration, Washington, D.C.

Available from the Clearinghouse as PB 185 950, $3.00 in paper copy, 0.65 in microfiche. Water Pollution Control Research Series, Report WP-20-18, June, 1969. 96 p, 11 tab, 23 fig, 13 ref, 4 append. FWPCA Contract No. 14-12-146. Program No 11020 DIH.

Descriptors: *Infiltration, *Sealants, Leakage, Groundwater, *Sewage.
Identifiers: *Infiltration control, Leaking joints, Polymers, Sewer lines.

The objective of this program was to develop new, more effective sealants for sewer line leaks (leaking joints, cracks and large holes). This purpose was achieved, and all equipments and materials investigated, tested or compared are presented, along with test results, supporting data, conclusions and recommendations. A wide range of candidate materials was surveyed, and weaknesses of rejected materials were noted. Meanwhile, specific properties of acceptable materials were ascertained and materials having these properties were identified. These latter materials were subjected to tests designed to demonstrate their effectiveness as sealants. Cost/effectiveness of the new sealant materials was compared with that of present sealant materials. It was concluded that infiltration adversely influences sewer system operating costs and effectiveness, and that leakage repair systems are limited in their effectiveness. Several sealants developed during the program were demonstrated to be able to effect strong, permanent repairs. No significant cost increase beyond that experienced with present sealers was indicated. Some present sealant application equipment can be modified for use with the new materials, but new equipment designs are described and recommended. Tooling-term field tests of the materials are recommended.
W69-10255

UNION CARBIDE'S BIODEGRADABLE SURFACTANTS FIGHT POLLUTION.

American Textile Reptr Vol 80, No 36, 1966. p 25.

Descriptors: *Biodegredation, *Surfactants, *Detergents, Water pollution control legislation, Textile chemicals, Test procedures, Emulsifiers.
Identifiers: Foaming agents.

Union Carbide's biodegradable surfactants for the textile industry are discussed in relation to water pollution. (Goodwin and Livengood-North Carolina)
W69-10262

INVESTIGATIONS INTO THE CENTRIFUGING OF WOOL-SCOURING LIQUORS FOR WOOL GREASE RECOVERY,
C. A. Anderson, and G. F. Wood.
J Text Inst, Vol 57, p T55-T64, 1966.

Descriptors: Centrifugation, Temperature.
Identifiers: *Wool grease, *Scouring waste, *Recovery (Waste), *Wool, Sludge-discharge centrifuge.

Centrifuges are frequently used for the recovery of grease from wool-scouring liquors, and experiments, were carried out using an Alfa-Laval sludge discharge centrifuge, type FVK4, to determine the effect of various factors on grease recovery. It was found that percentage recovery was independent of temp. in the range 57 deg - 82 deg C. and of feed rate in the range 1000-1400 gal./hr., but was inversely proportional to the gravity-disk diameter. In general the centrifuge was inefficient at settings that gave very low or very high conc. of grease in the product, the optimal conc. being 15 plus or minus 5%; procedure is described for adjusting the centrifuge for optimal production. (Livengood-North Carolina)
W69-10265

SIMPLE BIO-AERATION KILLS STRONG WASTES CHEAPLY.

Chem Eng, Vol 70, No 1, p 40-42, 1963.

Descriptors: *Aerobic treatment, Treatment facilities, Starch, Domestic wastes, Waste water treatment, Aeration.
Identifiers: *Desizing wastes, Textile wastes, Dyeing wastes.

The prolonged aerobic stabilization process developed by R. H. Souther has now been installed at a plant at Haw River, North Carolina, to treat a mixture of textile waste waters and domestic sewage, and at several other plants in North Carolina and Georgia. The advantages of this process, which can treat strong starch desizing wastes along with dyes and other waste waters are

indicated. The operation of the process is described briefly, and a flow diagram of the plant is given. (Livengood-North Carolina)
W69-10276

TEXTILE INDUSTRY WARS ON STREAM WASTE POLLUTION,
F. Allen.
Southern Textile News, Vol 22, p 1, 2, 10, 11, Aug 1, 1966.

Descriptors: *Pollution abatement, Water pollution control, *Waste water treat, Treatment facilities, Fish, Lagoons, Biochemical oxygen demand.
Identifiers: *Textile wastes, Zinc compounds, Recovery (Waste), Sodium hydroxide.

Textile industry efforts to combat stream waste pollution are illustrated with specific examples. (Goodwin-North Carolina)
W69-10277

WATER IN TEXTILE PROCESSING,
P. Bernhard.
Can. Textile J., Vol 82, p 45-52, 1965. 5 ref.

Descriptors: *Water resources, *Standards, Waste water (Pollution), Economic efficiency.
Identifiers: Textile processes (General).

Water resources, with particular reference to their characteristics and availability for textile processing operations, are discussed under the following headings: Water resources, qualitative requirements, characteristics of various water resources, water impurities, water economy (in textile plants), economic water distribution in textile plants and pollution. (Livengood-North Carolina)
W69-10278

FACTORS AFFECTING RECOVERY OF WAX FROM WOOL SCOURING LIQUORS,
C. A. Anderson.
Textile Inst., Vol 53, p 401-409, 1962.

Descriptors: Centrifugation, Oxidation, *Effluents, Sludge.
Identifiers: *Scouring waste, *Wool wax, *Recovery (Waste), *Wool, Wool fleece.

In the centrifugal method for the recovery of wax from wool scouring liquors yields are usually low and experiments have therefore been carried out on factors affecting recovery of the wax. It was found that recovery, which is reduced with increased oxidation of the wax, is greater from the scouring of base portions of the fleece than from tip portions. More wax is recovered from liquors from the scouring of lambs, locks and crutching wools than from the fleece wools. In many liquors, the larger drops in the disperse phase are not preferentially recovered by centrifuging; however, vigorous agitation, which reduces the drop size also reduces recovery and in practice, care should be taken to avoid excessive pumping and agitation of the liquors. Excessive use of soap in scouring reduced the yield of wax; this apprears to be due to alternarions in the composition of the drops and not to any change in size distributions of the disperse phase. Storage of the liquors was found to have no adverse effect on wax yield, although in some cases there is a change in the distribution of wax between the effluent and sludge phases. (Livengood-North Carolina)
W69-10284

AERATION RECOVERY OF LANOLIN FROM WOOL SCOUR LIQUORS,
C. A. Anderson.
Textile Res. J., Vol 30, p 51-57, 1960.

Descriptors: *Aeration, Treatment facilities.
Identifiers: *Scouring waste, *Wool, *Lanolin, *Recovery (Waste).

Investigation of the aeration process has resulted in an improved design for a continuous recovery plant. On a pilot scale the design has permitted throughput rates about 2 1/2 times greater than previous designs, with equal recovery efficiencies. (Livengood-North Carolina)
W69-10286

TENNESSEE RIVER BASIN WATER POLLUTION CONTROL COMPACT.

Ky Rev Stat Ann sec 220.551, 220.552 (1963).

Descriptors: *Kentucky, *Interstate compacts, *Water pollution control, *Interstate commissions, Legislation, Tennessee, Alabama, Georgia, Mississippi, North Carolina, Virginia, Legal aspects, River basins, Surveys, Water pollution, Water quality, Sewage treatment, Industrial wastes, Water supply, Pollution abatement, Waste treatment, Recreation, Navigation, Waste disposal, Fish conservation, Standards.

The Tennessee River Basin Water Pollution Control Compact is enacted and entered into by the state as a party. The compact is of full force and effect as between the state and any other compacting state. The purpose of the compact is to promote effective control and reduction of pollution in the waters of the basin. An interstate commission and control district is established to survey, study, and report pollution problems. The commission may recommend minumum standards of water quality. The personnel makeup and administrative workings of the commission are specifically provided for. The commission may establish reasonable physical, chemical, and bacteriological standards of water quality for various classifications of use. The commission's powers with regard to pollution abatement are laid out. The commission's powers extends only to situations where pollution does or is likely to affect the quality of water flowing among, between, into, or through more than one party state. The governor is authorized to enter into supplemental agreements with Tennessee for the regulation and abatement of water pollution in common river basins. (Keith-Florida)
W69-10296

INTERSTATE WATER SANITATION BOARD.
Ky Rev Stat Ann secs 220.560, 220.570 (1963).

Descriptors: *Kentucky, *Interstate compacts, *Environmental sanitation, *River basin commissions, Interstate rivers, Interstate commissions, River basins, Legislation, Legal aspects, Administrative agencies, Water quality control.

An Interstate Water Sanitation Board is established. Members of the Board will serve as members of interstate sanitation control commissions created by interstate compacts to which the state is a party. Provision is made for appointment to the Board and for member qualifications. The powers of the Board are those provided for in the aforementioned compacts and all powers necessary to the carrying out of those compacts. All other agencies and officers of the state are given a mandate to cooperate with the Board. (Keith-Florida)
W69-10297

GROUND WATER CONSERVATION.
For primary bibliographic entry see Field 04B.
W69-10298

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

STOCHASTIC MODEL FOR BOD AND DO IN ESTUARIES,
Virginia Polytechnic Inst., Blacksburg, Va.
For primary bibliographic entry see Field 05B.
W69-09879

MONTE CARLO SIMULATION OF WASTE DISCHARGE,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 05B.
W69-09880

PROPERTIES OF NON-HOMOGENEOUS HYDROLOGIC SERIES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
W69-09902

MATHEMATICAL MODELS FOR OPTIMIZING THE ALLOCATION OF STORED WATER,
Nevada Univ., Reno. Desert Research Inst.
William S. Butcher.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 714-723, 1968. 10 p, 23 ref.

Descriptors: *Water allocation (Policy), *Water distribution (Applied), *Systems analysis, *Optimization, Linear programming, Dynamic programming, Stochastic processes, Water storage, Water demand, Water utilization, Reservoir operation, Mathematical models.
Identifiers: Water storage system design.

In both the design and operation of a water-storage system, maximum efficiency requires determination of the optimal allocation of the available water. By using water storage, it is possible to allocate water over long times, in addition to allocating it within a time period. Determination of the optimal allocation of water can be approached in several ways, including the various mathematical modeling methods. To illustrate the alternative methods and the limitations inherent in them, a river basin was chosen to test and compare several methods by applying them to the situation. The methods discussed include 2 linear programming and 2 dynamic programming approaches. (Knapp-USGS)
W69-09918

IMPORTANCE OF MATHEMATICAL METHOD AND COMPUTING TECHNIQUE APPLICATION TO WATER RESOURCE PLANNING AND CONTROL,
All-Union Scientific Research Inst. of Hydrotechnics and Reclamation (USSR).
L. V. Dunin-Barcovsky.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 682-686, 1968. 5 p, 4 ref.

Descriptors: *Planning, *Water management (Applied), *Digital computers, *Operations research, Systems analysis, Optimization, Data processing, Data storage and retrieval, Data collections, Streamflow forecasting, Model studies, Analog models, Mathematical models.
Identifiers: *USSR, Water resources planning.

Subsequent economic development of some districts of the USSR completely depends upon effective planning and management of water resources. Therefore much prominence is given to the working out of mathematical methods and computer application for solution of these problems. Mathematical methods are being introduced into long-term planning, investigation, and design. Methods are being developed for optimal planning of water resource use in river basins and for large regions. The intensive development of mathematical methods and the increasing application of computers in water economy organizations are used in designing a single automatic system for collecting and processing data, planning, and managing water resources. (Knapp-USGS)
W69-09936

THE APPLICATION OF CROSS-SPECTRAL ANALYSIS TO HYDROLOGIC TIME SERIES,
Colorado State Univ., Fort Collins, Dept. of Civil Engineering.
Ignacio Rodriquez-Iturbe.
Colo State Univ Hydrol Pap No 24, Sept 1967, 46 p. Grant GK-1661 (NSF).

Descriptors: *Analytical techniques, *Statistical methods, *treamflow forecasting, *Synthetic hydrology, *Time series analysis, Regression analysis, Synthetic hydrology, Linear programming, Markov processes, Stochastic processes.
Identifiers: *Cross-spectral analysis.

The potentials of cross-spectrum and multiple cross-spectrum for the analysis of hydrological data were studied. Groups of precipitation and runoff stations were selected in different climatic environment and complete cross-spectral analyses were performed between those stations. The coherence and partial coherence functions were used for the study of frequency correlations between the series and they show that there exists a very strong correlation between the annual cycles of the stations. Along the Pacific Coast of the United States the annual cycles in precipitation appears to be basically the same up to distances of 1000 km. Cyclic regression analysis with the use of the gain and phase functions is shown to work correctly in hydrologic time series. This type of regression may be very useful in regions where frequency components account for a large percentage of the variance of the series. Cross-spectral characteristics of the moving average and autoregressive processes are shown to be a powerful tool in testing and analyzing these types of generating processes in hydrology. Special significance has the coherence between two 1st order autoregressive processes which is shown to be equal to a constant independent of frequency. The effects of smoothing or pre-filtering in the cross-spectral properties of 2 series are studied and recommendations made when working with this practice which is frequently used in hydrology. (Knapp-USGS)
W69-09938

SIMULATION OF ECONOMIC SYSTEMS,
Wisconsin Univ., Madison.
Guy H. Orcutt.
American Economic Review Vol 1, No 5, p 893-907, Dec 1960. 15 p, 25 ref.

Descriptors: *Simulation analysis, *Mathematical studies, Computers, Data collections, Statistics, Model studies, Economic analysis, Forecasting, Government, Taxes, Training, Design, Systems analysis.
Identifiers: *Economic systems, *Block-recursive models, Systems control.

Simulation is a general approach to the study and use of models, furnishing an alternative approach to that offered by conventional mathematical techniques. Various uses of simulation are described in Section I of this article (e.g., training uses, design uses, and systems control and forecasting uses). Models and model building are discussed in Section II. The third Section presents various means by which complex, large-scale systems can be simulated. The last section describes a concrete example of simulation of a demographic model of the United States. The author feels that a simulation approach to the study and use of models of economic systems has become essential due to the rapid development of survey research techniques and other improved means of data collection. With increased use of models to study the economic relationships in the water resource area, this article should be of use to the water researcher interested in the microeconomic problems of water resources. (Murphy-Rutgers)
W69-09949

SIMULATION OF INDIVIDUAL AND GROUP BEHAVIOR,
Ford Foundation, New York; and Carnegie Inst. of Tech., Pittsburgh, Pa.
Geoffrey P. E. Clarkson, and Herbert A. Simon.
American Economic Review Vol 6, No 5, p 920-932, Dec 1960. 13 p, 26 ref.

Descriptors: *Model studies, *Simulation, Economic analysis, Statistics, Computers, Microeconomics, Investment, Profits, Cost, Demand, Mathematical studies, Computer programming, Management.
Identifiers: *Aggregation, Duopoly, Microeconomics, Programming.

Simulation is a technique for building theories that reproduce part or all of the output of a behaving system. This paper outlines some methods for using simulation to study various aspects of an economic system. In particular, the author places special emphasis on microeconomic simulation--especially the simulation of individual economic actors and individual firms. A comparison is made between one-period change analysis and simulation. Various forms of simulation are explained, including dynamic macroeconomics, management science and economic decision-making. The uses of computers in simulation are discussed and some examples of microeconomic simulation are given. The author feels that the main advantages of simulation are in the complexity they permit, the possibility of avoiding construction of mathematical models and the new approaches offered to the aggregation problem. Because these problems are often encountered in the economics of water resources this paper should prove useful to the water researcher. (Murphy-Rutgers)
W69-09950

ALTERNATIVE ASYMPTOTIC TESTS OF SIGNIFICANCE AND RELATED ASPECTS OF 2SLS AND 3SLS ESTIMATED PARAMETERS,
Pennsylvania Univ., Philadelphia, Pa.
P. J. Dhrymes.
The Review of Economic Studies, Vol 36, No 106, p 213-226, Apr 1969. 14 p, 9 ref.

Descriptors: *Least squares method, Regression analysis.
Identifiers: *Asymptotic tests, *Two-stage least squares, *Three-stage least squares, Ordinary least squares, Aitken estimators, Classical general linear model.

The purpose of this paper is to put forth an alternative derivation of the two-stage (2SLS) and three-stage (3SLS) least squares estimators. In this context, 2SLS and 3SLS emerge, respectively, as ordinary least squares (OLS) and Aitken estimators in a suitably transformed system. It is shown that 2SLS estimation is (asymptotically) EQUIVALENT TO THE ESTIMATION OF PARAMETERS IN THE FRAMEWORK OF THE CLASSICAL GENERAL LINEAR MODEL. A by-product of this approach is a straightforward proof of the efficiency of 3SLS relative to 2SLS and the derivation of necessary and sufficient conditions for efficiency to materialize. Beyond this, the author derives alternative asymptotic tests of significance for the 2SLS estimated parameters based on the t-distribution with a well-defined degrees of freedom parameter. The results in this article were developed under the assumption that all predetermined variables of the model are exogenous; although it is conjectural that such results are applicable to the case where the model contains lagged endogenous variables. System econometric methods can be used in water research problems and this article generalizes the more complex 2SLS and 3SLS methods into the familiar techniques of least squares and generalized least squares analysis. (Loeb-Rutgers)
W69-09953

ON THE INTERPRETATION OF DISCRIMINANT ANALYSIS,
Columbia Univ., New York.
Donald G. Morrison.
Journal of Marketing Research, Vol 6, No 2, p 156-163, May 1969. 8 p, 3 fig, 5 ref, 1 append, 1 disc.

Descriptors: *Regression analysis, Statistic methods, Computer programs, Classification.
Identifiers: *Discriminant analysis, Linear classif cation, Statistical significance, Mahalanobis squared statistic, F statistic, bias.

Many theoretical and applications-oriented article have been written on the multivariate statistic technique of linear discriminant analysis. Howeve on a practical level little has been written on how t evaluate results of a discriminant analysis--at lea in managerial, as opposed to statistical terminol gy. This article looks at the problem of evaluatio from various viewpoints and thus highlights som features pertaining to other statistical technique Statistical methods have been used extensively i the water research area. For example, discrimina analysis and regression analysis are used quite e tensively in estimating such things as the deman for outdoor recreation and this article presents less technical discussion of certain techniques tha can be utilized in empirical water research. (Loeb Rutgers)
W69-09957

CAPITAL BUDGETING OF INTERRELATE PROJECTS: SURVEY AND SYNTHESIS,
Massachusetts Inst. of Tech., Cambridge.
H. Martin Weingartner.
Management Science, Vol 12, No 7, p 485-51 Mar 1966. 32 p, 47 ref.

Descriptors: *Budgeting, *Management, *Capita *Project planning, Linear programming, Optimiz tion, Capital supply, Research and developmen Financing, Resource development, Mathematic models, Costs, Investments, Benefits, Value, Profi Risks.
Identifiers: *Capital budgeting, *Interrelated pr jects, Randomness, Resource scarcity, Dynam programming, Integer programming.

This paper surveys the techniques available those who must decide on an investment progra consisting of a potentially large number of interr lated projects and also subject to constraints o capital and other resources. The author makes us of the techniques of linear and integer pr gramming, dynamic programming and the discre optimizing procedure of Reiter. These technique are used to analyze the Lorie-Savage problem maximizing total net present value of investment a ternatives. Interdependent projects with an without budget constraints are subjected to th same analysis. Project interrelationships arisin from randomness of outcomes and non-linear util ty functions are covered as well as interrelatio ships arising in research and development budget Due to presence of these budgeting problems i much of the water resource area, this article shou be of use to the water researcher. (Murphy-Ru gers)
W69-09971

ON THE EFFICIENT USE OF HIGH ASWA DAM FOR HYDROPOWER AND IRRIGATION
Harvard Univ., Cambridge, Mass.
H. A. Thomas, and R. Revelle.
Management Science, Vol 12, No 8, p 296-31 April 1966. 17 p, 5 tab, 2 fig, 8 ref.

Descriptors: *Irrigation, *Agriculture, *Economi analysis, Mathematical studies, Statistics, Wat supply, Costs, Demand, Reservoir, Wat resources, Capital, Salinity, Agriculture, Inves ment, Groundwater, Storage, Hydrology.
Identifiers: *High Aswan Dam, *Nile Rive *Hydropower, Complimentarity.

This paper attempts to describe some analytic methods that will be useful in the multidisciplina effort to select the best method of operating th High Aswan Dam and developing new resources t speed economic growth and social progress. mathematical model for computer studies developed to elucidate and quantify the relatio between the variables pertaining to agricultural an

power uses. The model incorporates some of the chief factors affecting efficiency of multipurpose operation for the generation of hydroelectric power and for increasing the agricultural production of the United Arab Republic. It is shown that relatively high proportions of the full potential of the system for irrigation and power generation can be developed to meet requirements of the rapidly developing region. (Murphy-Rutgers)
W69-09972

SYSTEMS ANALYSIS, OPERATIONS RESEARCH, AND STATE AND LOCAL BORROWING,
Auburn Univ., Ala.
Joseph M. Bonin.
Public Finance, Vol XIX, No 2, p 101-113, 1964. 13 p.

Descriptors: *Systems analysis, *Operations research, *Management, *Financing, *Government, Interest rate, Costs, Risks.
Identifiers: *Debt management, State borrowing, Local borrowing, Game theory, Bonds, Critical path, Queuing theory, Suboptimization.

The author wishes to show that systems analysis and operations research techniques may be applicable in studying borrowing problems. Suboptimization is said to be extremely useful but open to the errors of a fixation on a single input, the misuse of ratios, the neglect of spillover effects and higher level criteria. Each of these errors are discussed by the author. The usefulness of the operations research techniques of queuing theory, game theory and the critical path method in analyzing governmental borrowing is covered. California is used as an example for the application of these techniques the author feels these tools should be used in state and local debt management, subject to the limitations stated in the article. Due to the importance of debt financing in government water resource projects, this article should prove useful to the water researcher. (Murphy-Rutgers)
W69-09976

CALENDAR - DAY C P M,
Army Construction Engineering Research Lab., Champaign, Ill.
L. R. Shaffer.
ASCE, Civil Eng, p 65-68, August 1969. 4 p, 4 tab, 1 fig.

Descriptors: *Critical Path Method, Planning, *Scheduling, Operations, Integrated control measures.

The integration of the Critical Path Method and the Bar Chart Technique to improve planning and scheduling was discussed. The Bar Chart Technique of planning and scheduling allowed for the explicit integrated treatment of the how/how long/when aspects of operation but employed a notation that did not permit defining precisely the relationships among the operations; hence the operations might be assigned improper locations in the project's time frame. The C P M, on the other hand, was founded upon a sufficiently precise notation but its solution process did not allow explicit, integrated treatment of the how/how long/when aspects of an operation. The combining of the notation of C P M and the solution of the Bar Chart Technique was defined as CALENDAR - DAY C P M. Two schedules for the CALENDAR - DAY C P M, the Earliest Start Time (EST) and the latest Finish Time were described. The CALENDAR - DAY C P M provided the precision required in defining operations, while utilizing a solution process wherein the duration of the operation was correlated to the time of the year in which it was performed. (Thiuri-Cornell)
W69-10009

PREDICTION MODELS FOR INVESTMENT IN URBAN DRAINAGE SYSTEMS,
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
John W. Knapp, and Walter J. Rawls.
Water Resources Research Center Bull No 24, Virginia Polytechnic Instit, Blacksburg, Va, p 1-55, April 1969. 55 p, 7 fig, 15 tab, 15 ref.

Descriptors: *Mathematical models, *Investment, *Drainage systems, *Decision making, *Cost-benefit analysis, Design criteria, Planning, Economic feasibility, Geographical regions, Engineers estimates.

Linear models were developed and used to study the significant factors controlling costs of conventional urban drainage systems. The objective of the study was to find decision making tools which engineers and planners could employ for estimating the cost of alternative sizes of drainage facilities and the degree of protection to be afforded; and for judging the potential for development. Techniques of factor, component, and non-linear analysis were performed with data collected from 100 municipal agencies around the country. The study revealed that design practices as well as geographic areas were important. Physical features, although most important, were usually the fixed, uncontrollable variables. Design factors, on the other hand, were important in both degree and kind. The analysis explained the differences in the design methods and led to the development of equations to predict the cost for various levels of design. (Thiuri-Cornell)
W69-10011

CONJUNCTIVE USE OF GROUND AND SURFACE WATERS,
California State Dept. of Water Resources, Los Angeles.
James J. Doody.
J Amer Water Works Ass, Vol 61, No 8, p 395-397, Aug 1969. 3 p.

Descriptors: *Simulation analysis, *Conjunctive use, *Surface-groundwater relationships, *Transmissivity, *Optimization, California, Storage, Sediment yield, Water resources development, Mathematical models, Water management (Applied).

The use of mathematical techniques to obtain a least cost water management plan in California was discussed. A mathematical model was developed to provide a tool with which to simulate the dynamic behavior of the groundwater basin under various plans of operation. Each plan was operationally and economically evaluated. The characteristics most important to the model were the transmissive and storage values of the sediments within the basin; and the basin's geometry and structural boundary. The results of the separate analysis of the groundwater system and of the surface delivery network for each plan of operation were integrated into a coordinated operational study of the surface and subsurface facilities. This enabled the engineers and managers to select the most economical plan of operation. (Thiuri-Cornell)
W69-10012

DYNAMIC INPUT-OUTPUT ANALYSIS (PROGRAMMING ASPECTS),
California Univ., Berkeley. Sanitary Engineering Research Lab.
Jona Bargur.
Econ Evaluation Water Part VI, Chap 4, Water Resources Center Contrib No 128, Calif Univ, Berkeley, p 23-36, June 1969. 14 p.

Descriptors: *Input-output analysis, *Economic prediction, *Linear programming, *Decision making, *Planning, California, Water resources development, Leontief models, Constraints, Water demand.
Identifiers: Western States.

The characteristics of dynamic input-output models and the use of dynamic analysis to provide a time-sensitive approach to economic forecasting and planning decisions with regard to utilizing resources were discussed. The discussed models included the Leontief Dynamic Model, the Dorfman Dynamic Model, the Chenery-Clark Model and the Lange Dynamic Model. The application of a general dynamic model developed for studying the California and Western States water economy was also discussed. The study employed a linear programming technique as an aid to the planning of water resource development. Water was treated as a resource constraint for each of the regions in question, and projections of water demand were made for each economic activity, subject to a given technology of production and investment, and reasonable employment forecasts. (Thiuri-Cornell)
W69-10014

ECONOMIC EVALUATION OF WATER PART VI: A DYNAMIC INTERREGIONAL INPUT-OUTPUT PROGRAMMING MODEL OF THE CALIFORNIA AND WESTERN STATES WATER ECONOMY,
California Univ., Berkeley. Sanitary Engineering Research Lab.
Jona Bargur.
Econ Evaluation Water Part VI, Water Resource Center Contrib 128, Calif Univ, Berkeley, p 1-125, June 1969. 125 p, 1 fig, 24 tab, 110 ref.

Descriptors: *Input-output analysis, *Dynamic programming, *Regional analysis, *Optimization, Model studies, California, Linear programming, Planning, Constraints, Resource allocation, Computers.
Identifiers: Interregional analysis.

The objective of this study was to evaluate the dynamic aspects of an interregional economic model of California and the remaining states of the Pacific and Mountain Region and the application of programming techniques to the resulting empirical model. The elements of interregional, multiregional programming models and dynamic input-output models of major contributors such as Isard, Chenery, Strout and Stevens were reviewed and analyzed. With this background, the Interregional Dynamic Input-Output Programming Model was formulated and its use as an analytical device for regional and interregional water resources planning was reviewed. The constraints of the model were broadened so as to include capital and labor as well as freshwater availability. The optimization aspects were directly related to the computer work dealing with linear programming routines. The optimal solution provided the regional planner with an insight into the expected optimal growth of the different sectors under the assumptions underlying the model and projected growth of final goods and services in the economics of the two regions. (Thiuri-Cornell)
W69-10016

STATIC AND DYNAMIC ASSIGNMENT MODELS WITH MULTIPLE OBJECTIVES, AND SOME REMARKS ON ORGANIZATION DESIGN,
Texas Univ., Austin; Carnegie-Mellon Univ., Pittsburgh, Pa.; and Office of Civilian Manpower Management (Navy), Washington, D.C.
A. Charnes, W. W. Cooper, R. J. Niehaus, and A. Stedry.
Manage Sci, Vol 15, No 8, p B-365--B-375, April 1969. 13 p, 61 ref.

Descriptors: *Linear programming, *Optimization, *Personnel management, *Model studies, *Multiple-purpose projects, Design.

The assignment model of linear programming was developed and extended to allow for vector optimizations and dynamic interactions between assigned personnel and positions in each of which a variety of possible measures and approaches were explored. Formulations involving people-to-people as well as people-to-position matchings were also examined from the standpoint of organizations in which jobs could be fitted to people or vice versa as well as weighted combinations. Possible uses of such models for dealing with the problems of placing disadvantaged or handicapped persons were noted, but the analysis stopped short of the still

further possibilities offered new types of machine-technology and information systems designs. (Thiuri-Cornell)
W69-10018

GEOMETRIC PROGRAMMING: NEW OPTIMIZATION TECHNIQUE FOR WATER RESOURCE ANALYSTS,
Texas A and M Univ., College Station; and Texas Univ., Austin.
Wilbur L. Meier, Robert W. Lawless, and Charles S. Beighter.
Proc, Fourth Amer Water Resources Conf, N Y, p 524-533, Nov 1968. 10 p, 1 fig, 13 ref.

Descriptors: *Optimization, *Mathematical models, *Systems analysis, Digital computers, Water resources, Approximation method.
Identifiers: *Geometric programming.

The use of a new optimization technique, geometric programming, was discussed and its theory presented. Geometric programming derived its name from a generalization of the arithmetic-geometric mean inequality. Pioneered by Zener, Duffin and Peterson, geometric programming, permitted the direct solution of a large class of optimization problems which heretofore had to be solved by approximate techniques. Invariance properties, which were discovered as by-products of the solution algorithm, provided insight into the physical system being analyzed. It was concluded that many water resource optimization problems could be efficiently solved using this technique. The advent of computer algorithms for geometric programming promised to make it even more useful in the future. (Thiuri-Cornell)
W69-10020

LINEAR PROGRAMMING OF WATER TRANSFERS IN THE NEW YORK METROPOLITAN REGION,
Rutgers - The State Univ., New Brunswick, N.J.; Barnard Coll., New York; and Columbia Univ., New York.
George W. Carey, and Leonard Zobler.
Proc, Fourth Amer Water Resources Conf, N Y, p 658-668, Nov 1968. 11 p, 5 fig, 1 tab, 14 ref.

Descriptors: *Linear programming, *Water transfer, *Distribution systems, *Water resources, *Interagency cooperation, Optimization, Water allocation (Policy), Surplus water, Reservoir storage, Public benefits, Mathematical models, Regional analysis.

The objective of the study was to explore the possibilities available within the New York Metropolitan Region for the more efficient distribution of water resources which were already developed, so that the yield to the public could be maximized and reservoir spill minimized, before turning to the development of new extra-regional resources. An interagency quantitative model for water transfer from points of local surplus to points of local deficiency was developed. The topology of the water system was described and the interrelated elements of the system were discussed. A linear programming problem was formulated and solved to allocate regional water in the best way possible according to various alternative criteria sets proposed by the planners. Only a part of the model had been applied to real data. (Thiuri-Cornell)
W69-10023

PLANNING APPROACHES TO WATER RESOURCES DEVELOPMENT AND UTILIZATION IN ISRAEL,
Water Planning for Israel Ltd., Haifa.
A. Wiener.
IFAC, Haifa Symp, Comput Contr Nat Resources, Public Util, p 1-12, Sept 1967. 12 p.

Descriptors: *Optimization, *Resource development, *Systems analysis, *Operations research, *Simulation analysis, Water balance, Mathematical models, Aquifers, Markov processes, Streamflow forecasting.
Identifiers: The Sea of Galilee.

The applications of systems analysis and operation research to the planning and operation of Israel's water system as a whole and to its individual components by themselves were discussed. A simulation model for the national grid was set up in order to test alternative operational procedures, to ascertain trends in the water balance and to define the long term differences and surpluses in storage and conduct capacities. A probabilistic forecast of the countrywide storage system for the next few years was calculated by mathematical techniques. A mathematical Markov model was set up and rules were formulated for optimal control of the single storage reservoir, the Sea of Galilee, during flood. Mathematical models were also developed for determining optimal utilization of an aquifer as an element of a water resource system; for deriving optimum operational rules for the national water resource system and for determining the size of elements within a streamflow utilization project. Methods of solution were based mainly on techniques of mathematical programming and simulation. (Thiuri-Cornell)
W69-10026

ECONOMIC EVALUATION OF WATER: PART 6, A DYNAMIC INTERREGIONAL INPUT-OUTPUT PROGRAMMING MODEL OF THE CALIFORNIA AND WESTERN STATES WATER ECONOMY,
California Univ., Berkeley. Sanitary Engineering Reseearch Lab.
For primary bibliographic entry see Field 06B.
W69-10087

ECONOMIC EVALUATION OF FLOW AUGMENTATION: A SYSTEMS ANALYSIS CASE STUDY,
Northwestern Univ., Evanston. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05G.
W69-10190

SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE,
Texas Water Development Board, Austin.
Wilbur L. Meier, Arden O. Weiss, Donald E. Evenson, and George K. Young.
Texas Water Development Board Report, Aug, 1969. 1150 p. OWRR-14-01-0001-1975.

Descriptors: *Planning, *Water resources development, *Optimum development plans (Minimum cost), *Computer models, Model studies, Hydrologic models, Operations research, Systems analysis, Networks, Simulation, Optimization (Minimum cost), Linear programming, Sampling.

This research represents a first step towards the development of a computer-oriented planning system for use in the planning of large, multi-basin systems of reservoirs and connecting transfer links (river reaches and pump canals) such as the proposed Texas Water System. Eight interrelated computer programs (four Data Management Programs and four Simulation/Optimization Programs) and an approach for using these programs were developed. The purpose of the Data Management Programs is to provide the user with a convenient means for organizing, in the proper form, most of the data required by the Simulation/Optimization Programs. The purpose of the Simulation/Optimization Programs is to collectively define (1) when to construct proposed reservoirs and transfer links, (2) what should be the maximum capacity of each of the reservoirs and transfer links, and (3) what should be the operating policy for each of the reservoirs and transfer links, both during and after the period in which facilities are being added to minimize the present worth of their construction costs, their operation costs, and their maintenance costs. (Weiss-Texas Water Development Board)
W69-10292

6B. Evaluation Process

GEOLOGY FOR PLANNING IN MCHENRY COUNTY,
Illinois State Geological Survey, Urbana.
James E. Hackett, and Murray R. McComas.
Ill State Geol Surv Circ No 438, 1969. 31 p, 2 fig, 1 tab, 26 ref, append.

Descriptors: *Planning, *Urbanization, *Illinois, *Waste disposal, *Water supply, Geology, City planning, Decision making, Aquifers, Water yield, Data collections, Hydrologic data, Glacial drift, Limestones, Sandstones, Gravels, Sands, Engineering geology, Mineral industry, Farms.
Identifiers: McHenry County (Ill).

A study of the geology and natural resources of McHenry County was undertaken to provide the McHenry County Planning Commission with basic data for the formulation of a county plan. The collection and interpretation of the geologic data included the following steps: (1) detailed surficial mapping and subsurface study, correlated with soil mapping and supported by laboratory analysis, to differentiate all geologic units on the basis of composition and physical properties; (2) evaluation of geologic units in terms of their mineral-resource, engineering, and hydrologic properties; (3) preparation of interpretative maps in which areas are graded for specific land uses; and (4) analysis of terrains in which land units are differentiated on the basis of physiography and earth materials and evaluated in terms of their suitability for various land uses. The data developed in the course of these studies are adequate to establish patterns and relationships among the mineral- and hydrologic-resource factors for application to a regional plan. Individual site or local area plans require more intensive, larger scale investigations, generally involving on-site collection of subsurface data from controlled drilling. (Knapp-USGS)
W69-09912

ARKANSAS WATER RESOURCES: SUPPLY, USE, AND RESEARCH NEEDS,
Arkansas Univ., Fayetteville. Dept. of Economics.
For primary bibliographic entry see Field 06D.
W69-09940

WATER QUALITY AND FLOW OF STREAMS IN SOUTHEASTERN WISCONSIN,
Southeastern Wisconsin Regional Planning Commission, Waukesha.
For primary bibliographic entry see Field 05G.
W69-09947

SOME NOTES ON THE LINDAHL THEORY OF DETERMINATION OF PUBLIC EXPENDITURES,
Oslo Univ. (Norway).
Leif Johansen.
International Economic Review, Vol 4, No 3, p 346-358, Sept 1963. 13 p.

Descriptors: *Government, *Budgeting, Taxes, Welfare economics, Financing, Economic analysis, Prices, Supply, Equilibrium, Optimization, Total cost, Value, Costs.
Identifiers: *Public wants, *Public expenditures, Indifference curves, Pareto optimal, Lindahl.

The Swedish economist, Erik Lindahl, offered a solution to the problem of determining simultaneously the extension of expenditures for satisfying public wants and the distribution of the corresponding tax burden. This article is an attempt to present Lindahl's solution in terms of modern welfare-theoretical concepts and to elucidate some new aspects of the solution. The main problem is seen to be the determination of the amount of public expenditures and how the cost is going to be divided in the society. A solution is attempted using the indifference-curve approach in an effort to

derive the Pareto optimal points. An appraisal is made of the Lindahl solution from the point of view of equity and economic welfare. The author expresses doubts about the basis of Lindahl's theory, i.e. the treatment of public goods entirely in terms of individualistic preference scales. Due to the public good nature of governmental expenditure on water resource development, this article should prove useful to water researchers concerned with allocating costs to beneficiaries and determining the optimum amount of expenditures to be made in water areas. (Murphy-Rutgers)
W69-09951

COMPARISONS IN RESOURCE MANAGEMENT,
Resources for the Future, Inc., Washington, D.C.
Henry Jarrett.
Baltimore, Maryland, Johns Hopkins Press, 271 p, 1961.

Descriptors: *Conservation, *Water resource development, *Natural resources, Soil conservation, Multiple-purpose projects, Erosion, Flood control, Planning, Cooperatives, Recreation, Industries, Transportation, Population, Financing, Ecology, Forest management, Cost-benefit analysis, Water supply, Land resources, Watershed, National Parks.
Identifiers: *Sweden, *France, *West Germany, *Great Britain, *Canada.

The book contains a collection of articles on resource management. There are six cases examined, each of which deals with an important problem in both the United States and other countries. The author hopes to discover what useful lessons Americans can learn from foreign experience. In each case the nature of the problem in the U. S. is discussed, the experiences of the other country with it are related and the applicability of the foreign solution to the U. S. problem is brought out. The first three sections deal with problems of national park administration, small forest holdings and preservation of natural areas. Of interest to the water resource planner are the last three sections which deal with: water pollution abatement (the Ruhr district used as an example), the problem of integrating local problems with multiple purpose land and water districts (Ontario, Canada used as an example) and the problems of regional development with land and water development (Southern France used as an example). (Murphy-Rutgers)
W69-09952

A NOTE ON THE PARTITIONING OF A SINGLE PRODUCT MARKET INTO TERRITORIES OF OUTLETS,
Pennsylvania Univ., Philadelphia.
Shiv K. Gupta, and Christoph Maier-Rothe.
Journal of Marketing Research, Vol 6, No 2, p 232-236, May 1969. 5 p, 3 fig, 1 tab, 1 ref, 1 append.

Descriptors: *Distribution patterns, Costs, Transportation, Outlets, Prices, Distance, Demand.
Identifiers: Transportation costs, Territories, Cost function, Monotonic cost function.

Distribution of a good or service is an essential activity of every business. Distribution means transportation of goods from their source, the manufacturing plant or the warehouse, to their destination, the customer. In this article, the authors consider the effect of transportation costs on the size and shape of the area that any particular outlet serves. Several outlets offer the same product to a customer at some given location. It is assumed that, for a given outlet, price is a function of the distance between outlet and consumer, and the customer accepts the offer with the lowest price. First, the concept is illustrated by determining the territories of two outlets with linear cost functions. Then the results are generalized for n outlets and arbitrary monotonic cost functions. This methodology, when applied in the water area, can be used to estimate the number of customers or the demand of each outlet by integrating a given customer density or demand density over the respective territories. (Loeb-Rutgers)
W69-09955

TECHNOLOGICAL PROGRESS AND MICROECONOMIC THEORY,
California Univ., Los Angeles.
W. Z. Hirsh.
American Economic Review, Vol LIX, No 3, p 36-43, May 1969. 8 p, 12 ref.

Descriptors: *Research and development, *Technology, *Resources, Costs, Financing government, Demand, Incomes, Profit.
Identifiers: *Technological progress, *Productivity, Capital goods, Entrepreneurs, Property rights.

This paper attempts to shed light on the nature of technological progress and of the technologically progressive firm. Since microeconomic theory forms the basis for many decisions in the water resource area the discussion of some special problems faced by economists who seek to make this type of analysis, should prove useful. The basis is laid for the development of model to solve these problems that would allow for: (1) the determination of microeconomic policy by more than one set of preferences, (2) an explicit treatment of the choice of a production technique, (3) the possession of property rights over changes in technology, (4) financing to make specific allowance for sources of economies of scale, and (5) the effect of alterations in demand on expenditures. Methods by which the model may be used with each of these areas are suggested. (Murphy-Rutgers)
W69-09959

A NORMATIVE THEORY OF TRANSFERS,
RAND Corp., Santa Monica, Calif.
Edgar O. Olsen.
Public Choice Vol VI, p 41-55, Spring 1969. 15 p, 22 ref.

Descriptors: *Resource allocation, *Optimization, Model studies, Costs, Taxes, Income, Welfare economics, Statistics, *Government supports, Economic analysis, Supply, Demand.
Identifiers: *Transfers, *Optimal output, Normative distribution theory, Pareto optimality.

The author wishes to present a theory which will explain the preferences that justify transfers between individuals through government. The solution to this problem allows benefit-cost evaluations of government programs of a redistributive nature. The theory outlined is in the tradition of Lindahl, Bowen, Musgrave, Samuelson and Buchanan. It differs from these in that the optimal pattern of transfers is treated as part of the problem of efficient resource allocation rather than as a separate problem. The existing distribution of the ownership of productive factors is accepted as a constraint on the maximization problem while retaining interpersonal transfers in cash and in kind. Due to the importance of the governmental sector in the water resource area, this article could aid in theoretical treatments of methods to improve the efficiency of water resource allocation decisions. (Murphy-Rutgers)
W69-09960

THE REGIONAL MULTIPLIER--A CRITIQUE,
Glasgow Univ. (Scotland).
Thomas Wilson.
Oxford Economic Papers, Vol 20, No 3, p 374-393, Nov 1968. 20 p, 17 ref.

Descriptors: *Regional analysis, Taxes, Production, Economic impact, Investment, Prices, Government, Forecasting, Income, Economics, Industries.
Identifiers: *Regional economics, *Regional multiplier, *Regional development, Monetary policy, Industrial development, MPC, External economies.

The article attempts to determine the uses and limitations of the regional multiplier as an aid in regional policy. This is an area where the water resource planner often plays an essential part. The theory is elucidated and then modified to take account of secondary investment by firms operating in the market and also of induced public investment. It was found that it is not possible to reduce regional disparities by stimulating expenditure in the undeveloped areas without significant spillovers into developed areas. It was also found that little accuracy has been achieved in making the regional multiplier sufficiently operational to provide accurate estimates of secondary increases in expenditures. There is some possibility of using the regional multiplier as a guide to the physical planning of new or expanding towns. Finally, it was found that the regional multiplier cannot afford any guidance as to the kind of industrial structure that development policy might seek to foster. (Murphy-Rutgers)
W69-09961

TAXATION AND RISK-TAKING: AN EXPECTED UTILITY APPROACH,
Norwegian School of Economics and Business Administration, Bergen.
Jan Mossin.
Economica, Vol 35, No 137, p 74-82, February 1968. 9 p, 3 ref, 1 append.

Descriptors: *Risks, *Taxes, Interest rate, Tax rate.
Identifiers: *Risk-taking, *Expected utility, *Utility theory, Assets, Portfolio, Tobin, Musgrave, Full loss offset case, No loss offset case.

It is a popular notion that higher taxes tend to discourage risk-taking. In economic theory, however, the conclusions in this respect have been somewhat different. Tobin, in his, 'Liquidity Preference as Behavior Towards Risk,' and Musgrave, in his text, come to the conclusion that an increase in a proportional tax rate will, with full loss offset, increase the holding of the risky asset in a portfolio of a given size. Musgrave's analysis of the no-loss offset case leads to the result that the direction of the effect is indeterminate. In this article these problems are re-examined on the basis of expected utility theory. Without any serious loss of generality, the discussion is restricted to portfolio choices involving two assets only. It is assumed, however, that the yield on one of these is non-stochastic. It may be true that in the real world no such asset exists, but when a general utility function is used this assumption is necessary in order to get a relatively simple measure of risk-taking, simply by using the amount invested in the riskless asset. This type of analysis may be applicable to the water area and the associated investment problems and revenue requirements necessary for financing water development projects. (Loeb-Rutgers)
W69-09963

THE FRESH WATER OF NEW YORK STATE: ITS CONSERVATION AND USE.
State Univ. of New York, Buffalo.

Dubuque, Iowa, Wm C Brown Book Co, 1967. 255 p. Hitchcock, Lauren B (Editor).

Descriptors: *Freshwater, *Conservation, *New York, *Water resources, *Water pollution, *Energy, *Great Lakes, *Planning, Administration, Water management, Water pollution control, Limnology, Economics, Governments, Streams, Rivers, Lakes, Water quality control, Hydroelectric power, International Joint Commission, Legal aspects, International waters, River basins, Water quality.
Identifiers: Pollution causes, Urban planning, Political environment, Physical environment, Steam power, Nuclear power generation, Grand Canan Concept, Canada.

This volume is made up of the papers presented at a symposium held at the State University of New York at Buffalo. While directed primarily to the challenges confronting New York State, in the

water area, much of the discussion applies equally to current problems existing nationally and abroad. Major emphasis has been placed on man's needs--the goals toward which we must strive. An able summation is given of where we stand today, which should resolve some uncertainties, crystalize public opinion, and alert those in government and community life who may still view water problems with a degree of apathy. The symposium brought together representatives of virtually all fields concerned with water resources such as pollution causes and control, water resources management, limnology, hydrology, economics, urban planning, and government. These proceedings provide a comprehensive view of a major problem of society. There emerged the inescapable inference that not much will be accomplished until the federal government finances a much larger position of the multi-billions required to construct municipal and industrial treatment works, paralleling the country's experience in its expanded program of highways. (Loeb-Rutgers)
W69-09969

MUNICIPAL WATER FROM WESTERN RIVERS,
American Society for Testing and Materials, Philadelphia, Pa.
L. K. Cecil.
In Water Quality Criteria, p 5-12, American Society for Testing and Materials, Philadelphia, Pennsylvania, 1967. 8 p, 24 ref.

Descriptors: *Municipal water, Irrigation, Rivers, Water pollution, Water quality, Brines, Turbidity, Nutrients, Activated carbon, Algae, Evaporation, Herbicides, Pesticides, Mississippi River, Dams, Flood control.
Identifiers: *Western Rivers, Irrigation runoff, Power production.

Western rivers are considered to include the Mississippi and its western, but not eastern, tributaries, and all other rivers to the Pacific Coast. The diverse character of these rivers is well documented. Turbidity cannot be used as a common denominator, for some of these rivers have so little turbidity that the water needs no clarification for municipal use. However, man-made pollution may become a common denominator, considering such practices as airplane spraying of remote forest areas with pest control chemicals. The opening of vast areas of the semi-arid West to agricultural production required the construction of dams to even out the flow so water for irrigation would be assured. These dams were made large enough for flood control and power production. Thus, many Western rivers must be considered as rivers interspersed with very large lakes. The influence of these lakes as they affect the suitability of the river water for municipal use is considerable. Sophisticated analytical tools are needed to help the purification plant operator control treating systems and evaluate feasible economic alternatives for given water objectives. (Loeb-Rutgers)
W69-09970

ECONOMICS AND PUBLIC POLICY IN WATER RESOURCE DEVELOPMENT,
Colorado State Univ., Fort Collins.
Stephen C. Smith, and Emery Castle.
Ames, Iowa, Iowa State University Press. 463 p. 1965.

Descriptors: *Economic analysis, *Water resource development, Direct benefits, Indirect benefits, Flood control, Project planning, River basin development, Irrigation, Costs, Cost sharing, Groundwater, Productivity, Income, Cost allocation, Planning, Humid areas, Cost-benefit analysis, Treaties, Welfare economics.
Identifiers: *Economic development, Bureau of Reclamation, Assessments, Quantification, Water rights.

This book is a collection of articles on water resource development. The theoretical and practical issues of benefit-cost analysis are considered as well as the question of budget allocation as it relates to investment in water resources development. The relationship between economics and engineering is brought out. A section is devoted to the various aspects of quantification in the analysis of public investment in water resources economics. The area of financial responsibility is covered with concentration on the problems of pricing and costing. The relation between economics and water law is dealt with and concepts of water-rights, beneficial-use criteria and state and federal government roles are discussed. The last section of the book deals with the problems of increased urbanization of the economy as it relates to water organizations and water rights along with the question of political decision making in this area. (Murphy-Rutgers)
W69-09973

REGIONAL ECONOMICS: A SURVEY,
Harvard Univ., Cambridge, Mass.
John R. Meyer.
In Surveys of Economic Theory Vol 11, N Y St Martin's Press, p 240-271, 1965. 32 p, 130 ref.

Descriptors: *Economics, *Regional analysis, *Economic analysis, Programming, Income, Industrial production, Government, Transportation, Input-output analysis, Mathematical studies, Prices, Linear programming, Taxes.
Identifiers: *Nodal regions, *Economic development, Gravity model analysis, Location theory, Multiplier theory, Hypothesis testing.

This article seeks to describe the developments in the relatively new area of regional economics, including both its stimuli and conceptual precurors. The definitional problems of regional economics are considered in the first section. In section two a thorough consideration of the policy-problem stimuli is undertaken. The next section treats the theoretical foundations of regional economics, as taken from general economic theory. In Section IV there is a discussion of the different approach to regional economics that have emerged in actual regional studies. The author feels that regional economics is incomplete in a number of important respects. There should be a redirection of effort away from the design of broad conceptual frameworks and accumulation of regional income accounts towards the formulation and testing of behavioral hypothesis. The importance of regional analysis in water resources makes this article of interest to the water researcher. (Murphy-Rutgers)
W69-09975

NEW HORIZONS IN WATER RESOURCES ADMINISTRATION,
Resources for the Future, Inc., Washington, D.C.
Irving K. Fox.
Public Administration Review Vol XXV, No 1, p 61-69, March 1965. 9 p.

Descriptors: *Water resource development, *Government, *Watershed management, Economic analysis, Welfare economics, Investment, Technology, Government, Water pollution, Federal government, Flood damage, Water supply, Economic efficiency, Cost, Indirect benefits, Interest rate, Values, Irrigation, Demand, Institutional constraints, Systems analysis, Market, Political aspects.
Identifiers: *Water resource administration, Watershed programs, Regional water agencies.

The author tells of the magnitude of research in the area of water resources and gives the changes in the public water resource policies of the last fifteen years. He reviews welfare theory, the problems in water resource investments, and the policy-institutional framework within which decisions are reached. To foster efficient management and use of water resources in the public interest the author proposes: (1) policies which make use of market-type mechanisms to operate within public policy objectives; (2) restructuring the pattern of policy to allow politically-responsible resolution of policy issues; and (3) making greater use of various types of checking arrangements and countervailing influences to foster efficiency on the part of the institutions which supply water services. He concludes that technical economic progress has surpassed that on the administrative side and proposes the above policies for a more effective governmental water resources policy. (Murphy-Rutgers)
W69-09977

ECONOMICS AND THE ADMINISTRATION OF NATIONAL PLANNING,
Yale Univ., New Haven, Conn.
Charles E. Lindbolm.
Public Administration Review, Vol XXV, No 4, p 274-283, December 1965. 10 p.

Descriptors: *Planning, *Input-output analysis, *Economics, Systems analysis, Statistics, Industrial production.
Identifiers: *Market mechanism, *Public administration, *Central planning, Laissez-faire, Decentralization, Socialism, Development planning.

The contribution of economics to national economic planning is obvious. This article outlines the significance of accounting in national planning and the growth in understanding the market mechanism. The manner in which the market mechanism can be used as a device for planning is discussed as well as the way central planning operates. There is an explanation of how development may be achieved through various manipulations performed on the market mechanism. The study of the market mechanism is central to the study of plan administration since the market is the primary instrument for this planning. The article, especially the sections on planning and central planning, has particular relevance for the water researcher since it gives the basics of much of the theory behind the governmental planning of water resource policy. (Murphy-Rutgers)
W69-09978

CONCEPTS USED AS ECONOMIC CRITERIA FOR A SYSTEM OF WATER RIGHTS,
California Univ., Berkeley.
S. U. Ciriacy-Wantrup.
IN Economics and Public Policy in Water Resource Development, Ames, Iowa State University Press, p 251-271, 1965. 21 p, 33 ref. Edited by Stephen C. Smith and Emery N. Castle.

Descriptors: *Water rights, *Water resources development, *Cost-benefit analysis, *Riparian rights, Water utilization, Watersheds, Investment, Groundwater, Flow, Rigidity, Water allocation, Water law, Flexibility, Economics, Income.
Identifiers: *Quantitative techniques, *Macroanalysis, *Steiner model, *Activity analysis, Theory, Programming models, Political structure.

The article evaluates quantitative techniques in areas of application with emphasis on possible usefulness in decision-making situations. In water development and allocation, decisions are made both by the government and the private sector with more than one objective. These goals can be economic and non-economic; economic efficiency is usually primarily emphasized due to the availability of quantitative techniques. This often gives inadequate treatment to other objectives in the investment of public funds in water resources development. Although formal quantitative techniques are not a panacea, they should be encouraged since activity analysis of this type can improve on traditional planning procedures in numerous problems where objectives other than economic efficiency are unimportant. Further, such systematic evaluation procedures should lead to an improvement in data, as well as highlight the loss of efficiency in an existing situation. This implies that if the efficiency aspects of a problem are known, a better evaluation of the other objectives is permitted. (Murphy-Rutgers)
W69-09980

ACTIVITY ANALYSIS IN WATER PLANNING,
Oregon State Univ., Corvallis.
Emery N. Castle.
IN Economics and Public Policy in Water Resource Development, Ames, Iowa State University Press, p 171-185, 1965. 15 p, 1 tab, 23 ref. Edited by Stephen C. Smith, and Emery N. Castle.

Descriptors: *Water project planning, *Efficiencies, *Decision-making, *Water resources, Income, Measurement, Systems analysis, Canals, River basins, Watersheds, Reservoirs, Irrigation, Input-output analysis, Cost sharing, Flood plain zoning, Productivity, Recreation.
Identifiers: *Quantitative techniques, *Macroanalysis, *Steiner model, *Activity analysis, Theory, Programming models, Political structure.

This article deals with the relations between economics and law. As 'social engineering', law should define social optima, while economics should explain why and how far certain conditions decisively influenced by law facilitate or impede an increase of national income, pointing out the features of conflict situations and the probable consequences of changes in statutes, judicial decisions and administrative regulations. These consequences may be in quantitative terms or in terms of direction, magnitude, and rates of change. A beginning step to implement this law/economics relationship is mutual understanding of the interpretation and application of key concepts used as economic criteria. In water law, these would be security and flexibility of water rights. Since law is essentially a normative discipline, both normative and positive economics can contribute to this mutual understanding. Positive economics and law have many complementary relations, the exploration and strengthening of which will benefit both disciplines. Due to the treatment of water law in this article, it is of interest to water resource researchers. (Murphy-Rutgers)
W69-09982

ATTAINMENT OF EFFICIENCY IN SATISFYING DEMANDS FOR WATER RESOURCES,
Resources for the Future, Inc., Washington, D.C.
Irving K. Fox, and Orris C. Herfindahl.
American Economic Review Vol 54, No 3, p 198-206, May 1964. 9 p, 9 ref.

Descriptors: *Efficiency, *Water resources, Demand, River systems, Investment, Government, Costs, Cost-benefit analysis, Benefits, Marginal costs, Marginal benefits, Discount rate, Industrial water, Irrigation, Flood control.
Identifiers: *Corps of Engineers, Bureau of the Budget, Production function.

This article discusses the problem of how an efficient allocation of water resource investment can be approached more closely, given that the objective is to increase national income. It involves an assessment of the results of existing practices within the federal government upon efficiency. Thus, the key federal policies which bear on efficiency are examined. In addition reports of the Corps of Engineers on projects authorized by Congress in 1962 for construction are analyzed and a comparison is made between Corps projects authorized in 1962 with those of 1950. By this comparison the authors are able to offer insights into the working and results of the system for investment decision making. The benefit-cost evaluation practices are evaluated in terms of the marginality principle, the selection of discount rates and the success in these projects of estimating the demand functions for services derived from water. The authors recommend that to improve efficiency in satisfying demands for water services greater reliance should be placed upon charges and prices in the allocation process. An independent audit of planning activities is also recommended. (Murphy-Rutgers)
W69-09983

INTERREGIONAL INPUT-OUTPUT ANALYSIS (PROGRAMMING ASPECTS),
California Univ., Berkeley. Sanitary Engineering Research Lab.
Jona Bargur.
Econ Evaluation Water Part VI, Chap 3, Water Resources Center, Contrib No 128, Calif Univ, Berkeley, p 11-22, June 1969. 12 p, 1 tab.

Descriptors: *Input-output analysis, *Resource allocation, *Linear programming, *Regional analysis, *Water resources development, Leontief models, Public benefits, Economic feasibility, California, Evaluation, Optimization.

The study reflected a search for criteria for the evaluation of public policy in the development of water resources in California and the Western States. The objective was to optimize water resources management and develop the greatest benefit to the public. Interregional input-output and linear programming models were reviewed. The input-output models included the Leontief Balanced Model, the Isard Model and the Chenery-Moses Model. The interregional linear programming models included the Isard Linear Programming Model and the Stevens Model. The linear programming models were found to explicitly consider the dynamic element of the economic system. A dynamic interregional input-output programming model was developed and used for analyzing the optimal resource allocation. The model made it possible to establish reasonable projections of future economic development of the multiregional system with preassigned water and labor endowments. (Thiuri-Cornell)
W69-10013

THE INTERREGIONAL DYNAMIC INPUT-OUTPUT PROGRAMMING MODEL,
California Univ., Berkeley. Sanitary Engineering Research Lab.
Jona Bargur.
Econ Evaluation Water Part VI, Chap 5, Water Resources Center Contrib No 128, Calif Univ, Berkeley, p 37-53, June 1969. 17 p, 3 tab.

Descriptors: *Input-output analysis, *Dynamic programming, *Linear programming, *Regional analysis, *Resource allocation, Water management (Applied), Trade associations, Capital, Investment, Optimization.
Identifiers: Shadow prices.

In order to treat capital investment aspects as well as production aspects in an interrelated economy of two regions (California and other Western States) considering the optimum allocation of available water resources, various input-output models, linear programming models and dynamic input-output programming models were incorporated into one complete programming model. The formulation of an interregional dynamic input-output programming model with special attention to water resources management required the introduction of the dynamic aspect into each regional model of the two regions, and then the linking together by their trade balance. Once the complete model was formulated, its special features and usefulness were discussed and tested with actual data to evaluate the empirical results. Solutions to both the primal and dual linear programming maximizing problems were presented. The importance of shadow prices as expressions of the real value imputed to water under the assumptions of the model in an optimal solution was also discussed. (Thiuri-Cornell)
W69-10015

ECONOMIC EVALUATION OF WATER PART VI: A DYNAMIC INTERREGIONAL INPUT-OUTPUT PROGRAMMING MODEL OF THE CALIFORNIA AND WESTERN STATES WATER ECONOMY,
California Univ., Berkeley. Sanitary Engineering Research Lab.
For primary bibliographic entry see Field 06A.
W69-10016

ECONOMIC EVALUATION OF WATER: PART 6, A DYNAMIC INTERREGIONAL INPUT-OUTPUT PROGRAMMING MODEL OF THE CALIFORNIA AND WESTERN STATES WATER ECONOMY,
California Univ., Berkeley. Sanitary Engineering Reseearch Lab.
Jona Bargur.
Calif Univ Water Resources Center Contrib No 128, June 1969. 125 p, 1 fig, 24 tab, 110 ref, 4 append. OWRR Proj No B-017-CAL, WRC Proj No W112.

Descriptors: *Water resources development, *Economics, *Optimization, *Input-output analysis, *Mathematical models, Water management (Applied), Decision making, Dynamic programming, California, Arid lands, Social aspects, Costs, Cost-benefit analysis.
Identifiers: *Water resources economics.

A mathematical model is used to analyze the economic value of water in California and the other semiarid western States. Dynamic programming and input-output analysis are used to optimize water uses and costs, assuming that maximum economic growth is an accepted goal of society. The constraints of the model include capital and labor costs as well as water availability. (Knapp-USGS)
W69-10087

SEMPOR PROJECT-GENERAL PLAN,
Ministry of Public Works and Power, Djakarta (Indonesia). Water Resources Development.
For primary bibliographic entry see Field 08A.
W69-10100

A STUDY OF THE FEASIBILITY OF SOCIAL SCIENCE RESEARCH DESIGNED TO IDENTIFY AND ANALYZE SOCIAL RESPONSES TO PRECIPITATION MANAGEMENT OPERATIONS IN NEW ENGLAND,
New Hampshire Univ., Durham. Dept. of Political Science.
Roger S. Hoeh.
Report, Department of Political Science, University of New Hampshire, Oct 1968. 55 p, 2 append, 14 ref. Bureau of Reclamation, Order Number 8-D-3944, Amendment No 1.

Descriptors: Social aspects, Resources.
Identifiers: *New England, *Precipitation management.

This paper examines precipitation management in New England and possible directions of research on the social implications of precipitation management. Information used in the study was obtained from a sampling of the available literature related to precipitation management and interviews with people concerned with water resources. The study covers three areas. First, the state of the art or what precipitation management involves is examined. Second, New England's need for precipitation management and its experience with such operations are discussed. Finally, the directions that social science research may follow in assessing the social impact of precipitation management in New England is presented. A chapter on a recommended program of research is included. (Grossman-Rutgers)
W69-10192

MEETING STATE RESPONSIBILITY IN WATER RESOURCES DEVELOPMENT,
Colorado Univ., Boulder.
Calvin T. Watts.
IN Water: Development, Utilization, Construction, 5th Western Resources Conference, Boulder, Colo, p 127-134, 1963.

Descriptors: *Water resource development, *Louisiana, Budgeting, State jurisdiction, Administrative agencies, Planning.
Identifiers: Louisiana, *Dept. of Public Works.

Louisiana is a water-rich state; their problem is the management of that water because of threats of flooding, beach and shore erosion, salt-water intrusion, and uneven distribution of water with respect to time and place. In Louisiana, the Department of Public Works is the agency responsible for management at the state level. Its duties include planning, promoting, engineering and implementing the construction of all water projects affecting the general welfare of the state. It maintains a close relationship with local governmental units and water districts and works closely with Louisiana's Congressional delegation and with the state legislature. In addition, they also have many cooperative programs with federal agencies. The consequences of this type of public policy is reflected in the fact that Louisiana is one of four states who have made significant progress in water resources development and whose budget for water resources is around $10,000,000 annually. (Starr-Chicago)
W69-10194

TRENDS IN METROPOLITAN WATER DEVELOPMENT,
Colorado Univ., Boulder.
Don Hummel.
IN Water: Development, Utilization, Construction, 5th Western Resources Conference, p 115-124, 1963.

Descriptors: *Water resources development, *Water pollution control, Sewage treatment, Watershed management, Drainage basin, Interagency commission on water resources, State jurisdiction, Federal aid.
Identifiers: *Advisory Commission on Intergovernmental Relations, *Metropolitan comprehensive planning.

A report of the vice-chairman of the Advisory Commission on Intergovernmental Relations in which recommendations for state and federal action in metropolitan water resources development are made. The basic difficulties of inadequate investment in water and sewage facilities and the fragmented political responsibility in urban areas point to the need for more of a metropolitan approach to the planning and development of metropolitan water facilities. Five recommendations to the states are made: (1) Provide grants for sewage treatment plant construction to supplement federal aid; (2) provide incentives for comprehensive development on a watershed, drainage basin or metropolitan area bases; (3) expand state technical assistance programs; (4) liberalize debt limits and referenda requirements; and (5) permit joint action by units of local government in meeting their water and sewage needs. The recommendation to the federal government is that the grants made under the Water Pollution Control Act could be used as a more effective tool for metropolitan water planning if incentives were provided for more economical and comprehensive plans. (Starr-Chicago)
W69-10195

MUNICIPAL WATER IN FEDERAL PROGRAMS,
Colorado Univ., Boulder.
Henry P. Caulfield, Jr.
IN Water: Development, Utilization, Construction, 5th Western Resources Conference, Boulder, p 101-113, 1963.

Descriptors: Water supply, Local governments, Water quality, Federal jurisdiction, State jurisdiction, Social values, Political aspects.
Identifiers: Agricultural use vs. municipal use, State roles, Alternative uses of water.

An analysis of municipal water in federal programs is divided into two parts: (1) federal programs concerned with municipal and industrial water supply in relation to non-federal programs and the responsibilities of state and local government and of private enterprises; and (2) municipal and industrial water supply within the totality of federal policy, planning and action for use and development of water and related land resources. The basic role of the federal government is seen as a supportive one; with primary responsibility resting with municipalities. The state role, until recently, has been concerned with public health, determination of water rights, resolving interstate conflicts, and providing basic data of a geologic nature. Conflicts between alternative uses are pointed out, and the failure to adequately face consequences of each alternative is shown to be the one shortcoming of water planning. Agricultural use versus municipal use is viewed as merely involving the transfer of existing water rights from agricultural to municipal and industrial use. However, the subjective values which influence political decisions will play as important a role as the economic-objective values. (Starr-Chicago)
W69-10196

WATER POLICY THEMES AND PROBLEMS FOR THE 1960's AND 1970's SUMMARY AND CONTENT,
Colorado Univ., Boulder.
Michael F. Brewer.
IN Water: Development, Utilization, Construction, 5th Western Resources Conference, Boulder, Colo, 1963. p 225-231.

Descriptors: *Water resource development, *Research and development, Economics, Comprehensive planning, Water supply, Water demand, Administrative agencies.
Identifiers: Inter-disciplinary research.

A Summary of the 1963 Western Resources Conference; two phenomena relevant to present water policy are described: (1) a shift in the relative demands on water resources; and (2) an increased understanding of the close relationship between water and other natural resources. The shifts in relative demands under water-scarce conditions will not be solved by merely developing additional supplies, but, will necessitate curtailment in use elsewhere--or rationing of water to allow for equitable allocations among competing demands. The interdependency between water and other resources has increased the economic necessity for mutually consistent and comprehensive resource development and management policies. Arrangements need to be found for improving and extending common standards and criteria presently used by federal agencies. This will require a periodic process of review--not an agency-by-agency basis but by an interagency body to a professional and objective group. Rationale for allocation of research funds needs to be developed and existing rationale improved. There are too many dangers in rushing in at the federal level to fill a research gap. The contribution that economics can make is to provide a way of systematically assessing alternative ways of managing water resources in order to arrive at rational policy decisions. But the economist can neither define future problems nor develop alternative solutions without the help of the engineering, the social and the physical sciences--an inter-disciplinary approach is necessary and complementary. Efforts of many universities reflect their cognizance of the necessity of this approach. (Starr-Chicago)
W69-10200

ADVOCACY AND RESOURCE ALLOCATION DECISIONS IN THE PUBLIC SECTOR,
Bowdoin Coll., Brunswick, Maine.
A. Myrick Freeman, III.
Natural Resources Journal, Vol 9, p 166-175, April 1969.

Descriptors: *Decision making, *Resource allocation, Motivation, Social junction, Social aspects, Public benefits, Costs, Organizations, Conservation, Taxation.
Identifiers: *Advocacy, Sierra Club, Tax deductions.

A particular structure for making decisions in the public sector is considered and its implications for achieving an optimum resource allocation is discussed. Many decisions in the public sector are the result of a process of advocacy in which two interested parties or groups attempt to persuade or influence a decision maker to take or not to take a certain course of action. The role of the Sierra Club in the Grand Canyon Dam controversy and their subsequent loss of tax deductible status is a case in point. The process of advocacy is reduced to its essential elements and described by a model. An analysis of the behavior of the advocacy model considers two separate problems, the level of activity or advocacy cost which a group will choose, and the influence of advocacy on the decision. The larger the group the less chance there is of its organizing for collective action and maximizing benefit. The advocacy process is evaluated for efficiency as a way of making decision and as a process that makes the 'right' decisions. In conclusion, if advocacy is to be used as a decision-making process, the quality of decisions which result might be improved by policies designed to overcome the inherent disadvantages of large groups in the advocacy process, e.g., a subsidy. Costs of a subsidy shared by all taxpayers would be weighed against the benefits of better decisions, which would also be more widely distributed. (Marriott-Chicago)
W69-10203

A FRAMEWORK FOR DEALING WITH THE URBAN ENVIRONMENT: INTRODUCTORY STATEMENT,
Resources for the Future, Inc., Washington, D.C.
Harvey S. Perloff.
IN The Quality of Urban Environment: Essays on 'New Resources' in an Urban Age, Resources for the Future, Inc., Johns Hopkins Press, Baltimore, p 3-31, 1969. 2 tab, 1 append, 12 ref.

Descriptors: *Decision-Making, *Resources, Environment, Planning, Systems analysis.
Identifiers: *Urban environment, *Policy making, Social accounts, Social indicators.

Conceptual and measurement issues of the urban environment are the focal point of this study. Stressing aspects of policy-making and public action, it is pointed out that concepts which act to simplify and unify the complexities of the urban environment contribute to the development of a common ground of understanding. Two such concepts are suggested: an extension of the concept of resources, and the urban environment as a subsystem. The first concept suggests the need to consider non-commodity resources as well as the traditional commodity resources in the general concept of resources. The second concept stresses the view that the urban environment is a contained (but not closed), highly interrelated system or subsystem of natural and man-made elements in various mixes. Also discussed are policy measures and an analytic decision framework. This system consists in part of a set of different specific environments to be considered. Included are: the natural environment, the spatial environment, the transportation-utilities environment, the community-or-neighborhood environment, and microenvironments. These various environments can then be evaluated on the basis of various social indicators and accounts. These include indicators of present condition, costs of environmental maintenance at present levels, costs of environmental abuses and shortfalls, costs of achieving standards at various levels, and benefits of achieving standards at various levels. (Davis-Chicago)
W69-10206

THE ECONOMICS OF WATER TRANSFER,
California Univ., Berkeley. Giannini Foundation.
Michael F. Brewer.
Natural Resources Journal, Vol 4, No 3, p 522-536, Jan 1965. 10 ref.

Descriptors: *Water transfer, *Economic impact, Economic efficiency, Economic life, Equitable apportionment, California, Water distribution (Applied), Investment.

dentifiers: Water mobility, Value of public goods, Tenure forms, Payment forms, Self-adjusting economy.

The article discusses the way in which water ransfer arrangements affect economic growth. Section I analyzes the economic significance of water transfer. When economic growth is interpreted dynamically, the transfer not only allocates water, but also maintains a given rate of investment by agencies within the marketing spectrum. Section II discusses the functional relationship between water transfer and economic growth. The section focuses on: the relationship between water mobility and economic growth; quantitative problems involved in transfer between public and private agencies; the efficient transfer process, which is reflected by a high rate of growth and by the duration of that rate; and problems of equity. Section III assesses tenure forms and payment forms. Section IV traces the history of changing water institutions in California. There are five stages: (1) irrigation with local water; (2) development of more distant regional sources; (3) integrated management of ground and surface water; (4) coordination of jurisdiction among water supply agencies; and (5) provision for increasing urban demand. These mutations have permitted more efficient allocation as new problems become apparent, and they increase the probability that economic growth will be self-adjusting. (Gossen-Chicago)
W69-10208

THE INTERSTATE COMPACT--A FORM OF CREATIVE FEDERALISM,
Frederick L. Zimmermann.
Journal of Soil and Water Conservation, Vol 24, No 3, p 95-97, May-June 1969. 3 p.

Descriptors: *Interstate compacts, *Interstate commissions, *Water resources development, *Interagency cooperation, River basin commissions, Governments, Political aspects, State governments, Federal government, Interstate, River basin development, Legislation, Water law, Institutions, Regions, Basins.
Identifiers: Inter-level coordination.

As authorized by article 1, section 10 of the Constitution, interstate compacts have been used for a wide variety of purposes to meet growing intergovernmental problems in our federal system. The compact's uniqueness as a contract between or among enacting states makes it superior to uniform laws since no state may subsequently amend or withdraw except in accordance with its terms. These terms are enforceable in both state and federal courts. In addition to acceptance of the uniform document, states must also enact enabling statutes that aid effectuation of the agreement. The Constitution requires Congressional consent, but this may be obtained by implication with little opposition. The contractural nature of the interstate compact makes it the best legal instrument that can establish a joint agency of several jurisdictions which is also a joint agency of each of them. It is also used for interlevel coordination with state, local, and federal governments. Many operate without formal agencies; others are merely facilitative. The Delaware River Basin Compact is an excellent example of a truly inter-governmental agency, and it shows that despite federal reservations, this is a promising road to creative federalism. (Douberley-Fla)
W69-10214

WATER RECREATION - PUBLIC USE OF 'PRIVATE' WATERS,
Joseph B. Gaudet.
Calif L Rev, Vol 52, No 1, p 171-184, Mar 1964. 14 p, 110 ref.

Descriptors: *Recreation, *Riparian rights, *Water utilization, *Public benefits, Legal aspects, Land tenure, Recreation facilities, Riparian land, Bodies of water, Legislation, Flood control, Navigable waters, Non-navigable waters, Federal government, State governments, Judicial decisions, Relative rights.

Water recreation in America is rapidly increasing in popularity. The pressure of this increasing nationwide demand for water recreation coupled with the limited availability of adequate facilities will increasingly create conflicts between the public and riparians when, for example: (1) the state wishes to condemn a public access way to a body of water across privately owned riparian land; or (2) the public, already having access, wishes to use the body of water and the riparians object. Conflicts may arise among riparians if, for example: (1) one of several riparians, all of whom claim a right to use all or part of a body of water, wishes to exclude the others; or (2) a riparian resort owner admits members of the public to use the entire body of water and other riparians object. This comment explores the problems arising from these conflicts and evaluates attempted solutions in light of policy considerations and legal doctrine. There should be serious legislative consideration of to what extent the public need for water recreation should be satisfied through access way condemnation, improvement of existing bodies of water, inclusion of recreation facilities in flood control projects, and other similar methods. (Heckerling-Fla)
W69-10215

TRENDS IN WATER RIGHTS LEGISLATION.
Am Water Works Ass'n J, Vol 50, No 10, p 1267-1278, Oct 1958. 12 p.

Descriptors: *Water rights, *State governments, *Legislation, *Water resources, Water resources development, Surface waters, Groundwater, Water conservation, Research and development, Water policy, Legal aspects, Water supply, Water allocation (Policy), Water requirements, Adoption of practices, Administration.

One general trend in state water rights legislation as of 1958, is toward more state regulation of natural water resources. An examination of advances in water rights laws reveals that a number of eastern state legislatures are planning for, and engaging in, increased water conservation programs. Each state is treated separately, and its action or inaction in the area of water rights law is reported. Further, groups of states (such as the eastern central states, the Atlantic coast states, and the north central states) are dealt with as units; each unit is discussed by a different author. (Kelly-Fla)
W69-10217

WATER RIGHTS POLICIES IN THE SOUTHEAST,
C. P. Guess, Jr.
Am Water Works Assn J Vol 47, No 9, p 840-844, Sept 1955. 5 p.

Descriptors: *Southeast US, *Water management (Applied), *Water rights, *Water policy, Legislation, Federal government, Regulation, Water consumption, Control, Water users, Industries, Cities, Water demand, Industrial use (Water), Agriculture, Irrigation water, Water allocation (Policy), Water distribution (Applied).

There has been a pronounced acceleration in water management programs in recent years, particularly in the Piedmont and coastal areas of the Southeast United States. This is a result of a greatly increased consumption of water for irrigation, livestock raising, industries, and municipalities. Recent conflict among water users has been brought about by: (1) industrial expansion and development; (2) an increase in daily per capita requirements; (3) population increases; (4) population shifts; and (5) greater use in agriculture resulting from experience and research. Many states have already exerted the right to control and assign water. The federal government has recently passed legislation attempting to remedy these problems. The Southeast is well supplied with water at present; however, definite rules must be established in the field of water management for future growth. (Heckerling-Fla)
W69-10220

WATER RIGHTS AND ADMINISTRATION WITH RESPECT TO SOIL AND WATER CONSERVATION,
For primary bibliographic entry see Field 06E.
W69-10221

GREAT LAKES RIVER BASINS COMMISSION.
Ind Ann Stat secs 68-1401 thru 68-1404 (Supp 1968).

Descriptors: *Indiana, *Great Lakes, *Administrative agencies, *Great Lakes Region, St. Lawrence River, Water resources, Water resources development, Planning, Projects, Resources, Leadership, Coordination, Priorities, Construction, Legislation, Governments, Federal government, State governments.

The membership of Indiana in the Great Lakes River Basins Commission, established by the executive order of the President of the United States, is hereby ratified. The functions and duties of said Commission are to: (1) serve as the principal agency for coordination of federal, state, local, and nongovernmental plans for the development of water and related land resources within those portions of the eight Great Lakes states drained by the St. Lawrence River system; (2) prepare and keep up to date a comprehensive, coordinated, joint plan for such development; (3) recommend long-range priorities for the collection and analysis of data for investigation, planning, and construction of projects; and (4) undertake necessary studies of water and related land resources problems. The Indiana member of the Commission is appointed by and serves at the pleasure of the governor. The Department of Natural Resources provides administrative, technical, and advisory services to the Commission. (Marsee-Florida)
W69-10247

SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE,
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 06A.
W69-10292

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

RESOURCE ALLOCATION WITH PROBABILISTIC INDIVIDUAL PREFERENCES,
Harvard Univ., Cambridge, Mass.
Richard Zeckhauser.
American Economic Review Vol LIX, No 2, p 546-552, May 1969. 7 p, 2 ref.

Descriptors: *Risks, *Compensation, *Prediction, Demand, Preferences, Utilities, Income.
Identifiers: *Option value, *Actuarial model, *Collective consumption, *PIP, Risk sharing, Community insurance decision, Correlation, Nonvoluntary contribution.

This article is concerned with the allocation of PIP goods (goods to which some probability assessment has been attached for possible sets of individual preferences). Efficient provision of these goods demands they yield sufficient returns to enable discounted revenues to cover discounted expected costs, and that they provide a suitable amount of risk-spreading. In addition, allocation of PIP goods should involve the concepts of both utilities of anticipation and utilities of use. (Although there is only a slight chance of benefiting from consumption of a PIP good, for instance, the benefit may be sufficient to make the premium worthwhile.) Finally, it is generally best to provide PIP goods on a collective basis for efficiency of storage, for

aspects of collective consumption, and for cost-sharing provision. The essential character of PIP goods makes this article of interest to water researchers. (Murphy-Rutgers)
W69-09956

PROBLEMS IN THE THEORY OF PUBLIC CHOICE SOCIAL COST AND GOVERNMENT ACTION,
Virginia Polytechnic Inst., Blacksburg, Va.
Gordon Tullock.
American Economic Review Vol LIX, No 2, p 189-197, May 1969. 9 p, 3 fig, 1 ref.

Descriptors: *Market economies, *Welfare economics, *Government, *Optimization, Mosquitoes, Consumption, Cost, Compensation, Income.
Identifiers: *Externalities, *Collective provision, *Individual provision, *Paretian criterion, *Geographical contiguity, Single-peaked preferences.

This article presents a discussion of social cost by utilizing a technological discussion of mosquito abatement, for the reason that such a discussion reveals almost all decision problems which could be involved in reaching a solution for the problem. Government is involved, first of all, due to the large costs. These costs encourage voters to opt for collective provision for the problem in lieu of individual provision, even though a less than optimal arrangement of resources may result by their own preference ordering. Further, this collectivization process is preferred under small-size government units, since as the size of such units increases, the number of externalities internalized increases, and the adjustment of government activity decreases proportionately. Optimally when the quantity of public good consumed is determined by the voting process, as few individuals as possible should have need of compensation for losses suffered by the collectivization process. Finally, the area of public goods involves another problem for the governmental action in geographical contiguity, which often involves economies of scale. Since the water resource planner encounters the problems of public goods quite often, this article should prove useful. (Murphy-Rutgers)
W69-09958

A PUBLIC CHOICE APPROACH TO PUBLIC UTILITY PRICING,
California Univ., Los Angeles.
James M. Buchanan.
Public Choice, Vol V, p 1-18, Fall 1968. 19 p, 5 fig, 3 ref.

Descriptors: *Pricing, *Government, *Costs, Investment, Economic analysis, Political aspects, Average prices, Average cost, Marginal cost, Optimization, Supply, Equilibrium, Costs, Model studies, Taxes.
Identifiers: *Decreasing-costs, *Pareto optimality, *Public utility pricing.

The traditional problem of pricing and investment for decreasing-cost enterprises is examined in a model based on the assumption that individuals make collective as well as private consumption decisions. In a fully closed behavioral model, the analysis shows that when the necessary equality between marginal cost, marginal price, and marginal evaluation is satisfied, average price must equal average cost. The policy conflict between average-cost and marginal-cost pricing for increasing returns facilities does not exist. The analysis forms a defense of the multi-part tariff or club principle of pricing in decreasing-cost facilities. For Pareto optimality, marginal price need not equal average price and this equality cannot be realized when average costs fall throughout the relevant output range. Decreasing cost phenomena are a standard characteristic of many water resource investment projects and this treatment of the cost problem should be of interest to the water researcher. (Murphy-Rutgers)
W69-09962

COMMENT ON ECONOMY OF WATER QUALITY MANAGEMENT AND POLLUTION CONTROL,
Vulcan Materials Co., Birmingham, Ala.
For primary bibliographic entry see Field 05G.
W69-09965

ON THE PURE THEORY OF PUBLIC GOODS,
Rome Univ. (Italy). Instituto di Economia e Finanza.
G. Campa.
Public Finance Vol XXII, No 4, p 401-416, Spring 1967. 6 fig, 16 p.

Descriptors: *Optimization, *Welfare economics, *Resource allocation, Economic analysis, Costs, Value, Equilibrium, Cost sharing, Model studies, Pricing.
Identifiers: *Public goods, Indivisible goods, *Pareto optimality, Duopoly.

This article attempts to give a generalized theoretical framework to the voluntary solutions of the determination of public goods. It also seeks to indicate additional complications inherent in any attempt by a decentralized system to reach a Pareto-optimum when an indivisible good is involved. Further discussion concerns the contrasting results reached by the Lindahl-Johansen analysis and the Musgrave-Samuelson analysis. The theoretical discussion of the general case of public goods would be applicable to many water development projects which exhibit indivisible production constraints. (Murphy-Rutgers)
W69-09966

COLLECTIVE-CONSUMPTION SERVICES OF INDIVIDUAL-CONSUMPTION GOODS,
Wisconsin Univ., Madison.
Burton A. Weisbrod.
Quarterly Journal of Economics, Vol LXXVIII, No 3, p 471-477, August, 1964. 7 p.

Descriptors: *Demand, *Government supports, Marginal cost, Taxes, Government, Value, Recreation, Profit, Economic analysis, Economic efficiency, Prices, Industrial production, Welfare economics.
Identifiers: *Option-demand, *Collective-good.

A number of significant commodities exist which are apparently of a pure individual-consumption variety, but which also possess characteristics of a pure collective-consumption good. The author, after demonstrating the truth of this observation, discusses some of the implications. In particular, it is pointed out that even if some apparently individual-consumption goods cannot be profitably provided by private enterprise it may serve the social welfare to subsidize their production. The collective-good aspect of the commodity is pointed out to be the existence of option demand. The option demand can be satisfied at zero marginal cost when the actual uses of the commodity provide a profit. However, this option demand becomes critical at the margin. The option demand by potential users is particularly relevant to the area of water resources, with recreation and the national park system cited in the article as examples of the existence of option demand. (Murphy-Rutgers)
W69-09974

DISCRETE DYNAMIC PROGRAMMING AND CAPITAL ALLOCATION,
Johns Hopkins Univ., Baltimore, Md.; and Stanford Research Inst., Menlo Park, Calif.
G. L. Nemhauser, and Z. Ullmann.
Manage Sci, Vol 15, No 9, p 494-505, May 1969. 12 p, 1 fig, 3 tab, 19 ref.

Descriptors: *Dynamic programming, *Capital, *Resource allocation, *Optimization, *Return (Monetary), Investment, Constraints, Variability.
Identifiers: Borrowing, Lending.

Dynamic programming algorithms were developed for optimal capital allocation subject to budget constraints. The work included multilevel projects, reinvesting returns, borrowing and lending, capital deferrals, and project interactions. Due to the monotone non-decreasing step function nature of optimal returns it was possible to handle dynamic programming models with several state variables. Computational experience with a variety of problems was reported. (Thiuri-Cornell)
W69-10017

WATER RIGHTS LAW IN IOWA,
M. K. Tenny.
Am Water Works Assn J, Vol 51, No 3, p 329-332, Mar 1959. 4 p.

Descriptors: *Iowa, *Water rights, *Legislation, *Water allocation (Policy), Adjudication procedure, Administrative agencies, Natural flow doctrine, Riparian rights, State governments, Legal aspects, Water law, Water utilization, Beneficial use, Permits, Riparian land.
Identifiers: Water commissioner.

The Code of Iowa, as amended by the Iowa legislature in 1957, provided for an office of water commissioner to be chosen by the state's Natural Resources Council. The commissioner's duty is to process all applications for water appropriation permits. The present policy (October 1958) seems to be to approve all requests for water for what he and his deputies decide are beneficial uses of water. If an application is opposed, the burden of proof is placed by the commissioner on the opposition. Under the riparian doctrine, which was the law in Iowa previous to this amendment, a person owning riparian property was entitled to the use of the water flowing by in its natural current or channel, undiminished in quantity and unimpaired in quality. The new statute makes it the duty of the water commissioner to serve in a quasi-judicial capacity as the trier of fact questions in the processing of all applications for appropriation permits. (Heckerling-Fla)
W69-10216

6D. Water Demand

WATER REUSE: A TEXAS NECESSITY,
Texas Water Quality Board, Austin.
For primary bibliographic entry see Field 05D.
W69-09882

ARKANSAS WATER RESOURCES: SUPPLY, USE, AND RESEARCH NEEDS,
Arkansas Univ., Fayetteville. Dept. of Economics.
Jared Sparks.
Arkansas Univ Water Resources Res Center Pub No 2, 1967. 100 p, 15 fig, 10 tab.

Descriptors: *Water resources development, *Arkansas, Research and development, Water supply, Water utilization, Water management (Applied), Floods, Flood control, Surface waters, Groundwater, Hydrologic data, Data collections, Limnology, Water pollution, Water pollution control, Reservoirs, Industrial water, Municipal water.
Identifiers: Water resources research.

Arkansas' water resources research needs are discussed against an economic backdrop of water supply and use conditions existing in the state. In the aggregate Arkansas has an abundance of high quality water relative to present use. There are local conditions that give rise to water problems, but, in general, critical water problems in Arkansas are emergent and potential rather than actual. The causes of these problems are to be found, in large part, in the economic, legal, and social institutions surrounding water use--and particularly in the economic institutions. Research designed to improve economic efficiency criteria and to develop methods of applying such criteria to water resources planning, to water resources allocation, and to quality of water control would do much to mitigate the problems of water management in the future. Research of this nature requires con-

siderably more water data concerning supply, use, and costs associated with water use than are now available. Other promising areas of research include basic research on the nature of water and the water cycle, and applied research in areas of flood control, artificial recharge, the measurement of pollution damage and costs, the identification and treatment of pollution, the limnology of artificial lakes, and the role of water resources in industry location. (Knapp-USGS)
W69-09940

WATER USE IN THE PETROLEUM AND NATURAL GAS INDUSTRIES,
Bureau of Mines, Washington, D.C. Div. of Statistics.
Paul M. Buttermore.
Bur Mines Inform Circ No 8284, 1966. 36 p, 9 fig, 16 tab, 10 ref, append.

Descriptors: *Water utilization, *Oil industry, Drilling, Natural gas, Injection, Water reuse, Reclaimed water, Secondary recovery (Oil), Data collections.
Identifiers: Oil industry water use, Oil refining.

As part of a national canvass of water use the Bureau of Mines compiled data on water requirements in the petroleum and natural gas industries for the calendar year 1962, specifically in well drilling, secondary-recovery operations, and natural gas processing plants. Total new water use in the petroleum industry of the United States, excluding refining, was 5.3 billion barrels. Secondary-recovery operations and natural gas processing plants required about 2.5 billion barrels of new water input; each of these requirements was about eight times greater than that for well drilling. Total use, including recirculated water, was 45.3 billion barrels of which 3.4 billion barrels was consumed. The greatest use of recirculated water was for natural gas processing, amounting to 38.2 billion barrels. Projections of total water use show that by 1975, 75.4 billion barrels will be used by the petroleum industry, of which 10.2 billion barrels will be new water. By 1985, the total use requirement will be 92.8 billion barrels, of which 13.1 billion barrels will be new water. (Knapp-USGS)
W69-09944

FORESTS--NATIONAL SUPPLIES AND DEMANDS FOR WATER,
Forest Service (USDA), Washington, D.C. Div. of Watershed, Recreation, and Range Research.
For primary bibliographic entry see Field 03B.
W69-10004

ECONOMIC ASPECTS OF PRIVATELY OWNED FISHING ENTERPRISES IN WISCONSIN,
Economic Research Service, Washington, D. C. Natural Resource Economics Div.
Rudolph A. Christiansen, Sydney D. Staniforth, Aaron Johnson, Jr. , and Rollin B. Cooper.
Research Report 46, Research Division, College of Agricultural and Life Sciences, University of Wisconsin, June 1969. 13 p, 1 fig, 17 tab.

Descriptors: *Boating, *Sport fishing, *Financial analyses.
Identifiers: Wisconsin, Ownership of recreational facilities, Economic survey.

In 1966 Wisconsin contained 5,734 privately owned outdoor recreation enterprises. Of these, 1,516 offered fishing facilities. Fishing was a major activity at 34% of these enterprises. The most common form of ownership was individual. The fishing enterprises were seasonal, part-time enterprises. Data on the amount of income and the distribution of capital among different sized enterprises is included. Factors important in running successful enterprises are: getting along with the public and knowing the business. The best form of advertisement are satisfied customers. Some problems of operation are discussed. (Grossman-Rutgers)
W69-10191

WASTE WATER RECLAMATION, LOS ANGELES COUNTY,
Colorado Univ., Boulder.
For primary bibliographic entry see Field 05D.
W69-10197

RESEARCH AND DEVELOPMENT FOR REUSE OF WATER,
Colorado Univ., Boulder.
For primary bibliographic entry see Field 05D.
W69-10198

WATER RESOURCES RESEARCH,
Colorado Univ., Boulder.
E. D. Eaton.
IN Water: Development, Utilization, Construction, 5th Western Resources Conference, Boulder, Colo, 1963. p 201-213.

Descriptors: *Research and development, Public benefits, Water supply, Water demand, Federal budgets, Federal project policy.

Since requirements for water are rapidly growing while the amount of available water is fixed, research is seen as the means of enlarging the amount of available water for use. A report of a task group established by the Office of Science and Technology identified five areas which require research by the federal government: (1) planning for development and use of controllable supplies; (2) increasing supplies for beneficial uses; (3) improving the efficiency of use; (4) maintaining and improving water quality; and (5) preventing water-caused damage. An examination of federal research programs in water for the fiscal year 1964 led to the conclusion that greater emphasis should be given to intramural and extramural education and training, to research on water quality, and to socio-economic research. The difficulty of assessing projects which will yield the greatest benefits is pointed out, as well as the need for coordination in water resources research, the need for qualified research personnel, and the inter-relationship between research and public policy and decision-making. (Starr-Chicago)
W69-10201

IMPACTS OF RECREATION ON COMPETITION FOR USE OF WATER,
Colorado Univ., Boulder.
Walter S. Hopkins, Jr.
IN Water: Development, Utilization, Construction, 5th Western Resources Conference, Boulder, Colo, 1963. p 151-161.

Descriptors: *Outdoor recreation, Swimming, Boating, Access routes, Economic impact, Multiple-Purpose projects, Reasonable use, Water quality, Reservoir operation, Competing uses.

With the present trend for water-based recreation expected to continue, the article estimates that by the year 2000 swimming will be the most popular single outdoor recreation activity. A number of economic studies have attempted to place a monetary value upon the intangible of a recreation experience; a more productive approach has been to measure the impact of recreation on the economy of an area. The impact of recreation on municipal water supply has been considered resulting in two widely held conclusions: (1) swimmers and other recreationists do not create any pollution problem that can't be handled by existing water treatment facilities; and (2) it is unfair for all taxpayers to pay the cost of filtration plants in order to take care of the recreational needs of a few. The greatest impact of recreation has been its influence upon multi-purpose water impoundment. Management of impoundments built for a single purpose yields reservoirs which are less than ideal for recreational purposes. The problem of access to these man-made impoundments is also a serious one; acquisition of private lands well above the high-water mark will help alleviate this problem. The major recommendation of the article: the concept of comprehensive planning for water resource development throughout the nation to be enlarged to include all purposes served by water resources. (Starr-Chicago)
W69-10202

RESEARCH ON NATURAL RESOURCES: A REVIEW AND COMMENTARY,
Conservation Foundation, Washington, D.C.
Samuel H. Ordway, Jr., Wallace D. Bowman, and John Milton.
Natural Resources Journal, Vol 4, No 1, p 42-66, May 1964. 17 ref.

Descriptors: *Water demand, Methodology, Conservation, Systems analysis, Optimization, Ecological distribution, *Water resources development, Mineralogy, Energy, Social aspects, Economics.
Identifiers: *Research needs, *NAS-NRC Committee on Natural Resources, *Federal Council for Science and Technology, Renewable resources, Marine resources.

The article summarizes and evaluates the findings of the NAS-NRC Committee on Natural Resources and of the Federal Council for Science and Technology. It supports the major recommendation, gleaned from both reports, for more integrated research on the environment. Section I discussed the NAS-NRC summary report and its six supporting studies on: renewable resources; water resources; mineral resources, energy resources; marine resources; and social and economic aspects of natural resources. The summary report emphasizes the need for understanding the interplay between the social and natural sciences to meet requirements of productivity 'without lasting damage to our natural endowment.' The reports on water and marine resources explicate research priorities in water management. The report on social and economic aspects compares established policies with a view of the world as a complex set of systems, which must be continually analyzed for the optimum use of each factor. Section II contrasts the Federal Council's report with the NAS-NRC report. The Council's approach is primarily economic and technological; its concern is increasing the gross national product. The NAS-NRC approach is primarily ecological; its concern is sustaining the resource base and a total environment. (Gossen-Chicago)
W69-10210

DETERMINING WATER REQUIREMENTS FOR SETTLING WATER DISPUTES,
Harry F. Blaney, and Wayne D. Criddle.
Natural Resources Journal, Vol 4, No 1, p 29-41, May 1964. 3 tab, 19 ref.

Descriptors: *Consumptive use, Water distribution (Applied), Water utilization, Water requirements, Irrigation water, Negotiations, Judicial decisions, Legislation.
Identifiers: *Blaney-Criddle formula.

Before the equitable division of waters of a drainage basin can be made, careful consideration must be given to the consumptive-use requirements for water in each sub-basin. Consumptive use of water (evapotranspiration) and resultant stream depletions are of utmost importance to water users sharing limited supplies. Section I describes the Blaney-Criddle formula to determine consumptive use by vegetation. Section II documents use of the B-C formula in specific areas, including: water requirements for irrigated areas; compact negotiations; adjudications; litigation; and international negotiations. An example of computations of water use in Arizona, New Mexico, Utah, California, and other western states is given. Compact negotiations between the states in the Upper Rio Grande, Pecos River, and Colorado River basins employed B-C calculations. Some state engineers have based diversion allocations of agricultural water on B-C computations. The formula has been called upon in litigation of water rights in states of the lower Colorado River basin. Although political agreement on Jordon River waters has not been reached,

it is felt that technical agreement was reached through the B-C approach. The B-C method has greatly facilitated treaty negotiations between Pakistan and India. (Gossen-Chicago)
W69-10211

6E. Water Law and Institutions

POWER TO ACQUIRE AND DISPOSE OF PROPERTY; RESTRICTIONS AS TO DISPOSITION OF WATER FRONT.

Ky Rev Stat Ann sec 87.080 (1963).

Descriptors: *Kentucky, *Cities, *Leases, *Shores, Legislation, Transportation, Land tenure, United States, Rivers, Facilities, Administrative agencies, Piers, Local governments.
Identifiers: *Water front.

The city council may not dispose of any water front property, except when required by the United States Government for the improvement of rivers and facilities for water transportation along the water front. The city council may lease the water front for a term not exceeding twenty years. However, wharf privileges shall not be leased for more than five years. (Heckerling-Fla)
W69-09889

LANDS IN OHIO RIVER BED.

Ky Rev Stat Ann sec 56.220 (1963).

Descriptors: *Kentucky, *Ohio River, *Beds, *Leases, Legislation, Accretion (Legal aspects), Streams, Islands, Judicial decisions, Land use, Contracts, Sands, Gravels, Ownership of beds.

All that portion of the bed of the Ohio River lying north of the thread of the stream, except accretions to islands privately owned, is declared to be vacant and unappropriated land, and the county court of each county bordering on the Ohio River may use or lease the river bed for county purposes upon such terms and conditions as seem beneficial to the county. Any contract of leasing made by any such county court of such river bed for any sand and gravel rights for or on behalf of the county conveys full right and title to the lessee to the exclusive use of all sand and gravel deposits in the river bed to the extent embraced in the lease. (Heckerling-Fla)
W69-09890

6816.5 ACRES OF LAND V UNITED STATES (VALUATION OF PROPERTY IN CONDEMNATION PROCEEDING).
411 F2d 834-840 (10th Cir 1969).

Descriptors: *Reservoir construction, *Condemnation, *Condemnation value, *Compensation, Reservoir design, Reservoir sites, Water conservation, Water level fluctuation, Eminent domain, Federal government, Detention reservoir, Legal aspects, Judicial decisions, Recreation, Flow control, Access routes.

Appellant landowner contended that the award granted him in a condemnation proceeding initiated by the United States was inadequate and was based upon speculative assumptions made by government witnesses. The land in question was condemned to be used in the construction of a reservoir as part of a federal water reclamation project. The government's expert witnesses based their suggested award to the condemnee on the value of the land taken and on the alleged increase in value to appellant's remaining land due to its frontage on the new reservoir. The court found the assumed increase in value to be unwarranted since there would be a restricted view of the water from appellant's remaining land. Further, there would be no unique access to the water for appellant, and no direct access to government recreational facilities located at the reservoir. The court stated that the government must rationally and specifically explain its valuation of the land, and that it could not rely upon speculative or remote possibilities of benefits to appellant in making its award. The case was reversed and remanded for a new valuation of the property. (Kelly-Fla)
W69-09907

DRAINAGE OF ROADBED.
Ark Stat Ann sec 73-627 (1957).

Descriptors: *Arkansas, *Drainage, *Railroads, Ditches, Legislation.

It shall be the duty of any railroad to drain their respective roadbeds in all cases where such lack of drainage has been caused by the roadbed. (Darragh-Fla)
W69-09945

A PROPOSED PARTNERSHIP COMPACT FOR OUR NATION'S RIVER,
Potomac River Basin Advisory Committee, Washington, D.C.
A. C. Watson.
Journal of Soil and Water Conservation Vol 24, No 3, p 89-94, May-June 1969, 6 p, 5 ref.

Descriptors: *Federal government, *Interstate compacts, *Water pollution, *Water quality, *Water resources development, Topography, Rivers, Water gaps, Droughts, Flooding, Sewage, Estuaries, Jurisdiction, Economies of scale, Water supply, Groundwater, Decision-making.
Identifiers: *Potomac River Basin, *Shenandoah, *Great Falls, Gorges, Federal task force, Studies.

This article gives the Potomac River Basin Advisory Committee's recommendation for the 'best possible kind of intergovernmental organization to provide the concerted action needed to solve the problems of the Potomac.' Primarily, the Potomac needed a recognized and accepted basinwide leadership to correlate all the local interests involved in order to make the best use of the available resources. An advisory committee with representatives from Maryland, Virginia, Pennsylvania, West Virginia, and the District of Columbia was formed to fill this need. This committee has launched a concerted effort to control water pollution of the Potomac, aided both by the Federal and local governments concerned with the problem. A compact resulted in the Potomac River Fisheries Commission, that concentrates on water quality problems. This commission if changed to an interstate body would be an intergovernmental agency, able to deal with basinwide problems without affecting its legal base or structural characteristics. In addition, the agency would assure compatability of various local programs and makes possible efficient long-range planning, economies of scale, and instituting emergency measures. Flexibility would be the key, with the agency responsible for internal organization and administration, being financed by the various governments it served. (Murphy-Rutgers)
W69-09954

THE RANGE OF CHOICE IN WATER MANAGEMENT,
Resources for the Future, Inc., Washington, D.C.
For primary bibliographic entry see Field 05G.
W69-09964

WATER QUALITY CRITERIA.
American Society for Testing and Materials, Philadelphia, Pa.
For primary bibliographic entry see Field 05G.
W69-09967

STANTON V TRUSTEES OF ST JOSEPH'S COLLEGE (RESPECTIVE RIGHTS OF UPSTREAM AND DOWNSTREAM RIPARIAN OWNERS WHEN UPSTREAM USE IS TO BE NON-RIPARIAN).
For primary bibliographic entry see Field 05G.
W69-09968

NEW HORIZONS IN WATER RESOURCES ADMINISTRATION,
Resources for the Future, Inc., Washington, D.C.
For primary bibliographic entry see Field 06B.
W69-09977

CONCEPT OF REASONABLE BENEFICIAL USE IN THE LAW OF SURFACE STREAMS,
Wyoming Univ., Laramie.
Frank J. Trelease.
IN Economics and Public Policy in Water Resource Development, Ames, Iowa State University Press, p 272-292, 1965. 21 p, 162 ref. Edited by Stephen C. Smith and Emery N. Castle.

Descriptors: *Water law, *Riparian rights, *Priorities, *Preferences, *Water rights, *Beneficial use, *Reasonable use, Irrigation, Navigation, Streams, Air conditioning, Transportation, Compensation, Water allocation, Mining, Soil conservation, Stock water, Recreation, Fisheries.
Identifiers: *Laissez-faire economics, *Human life and health, Rights, Power, Manufacturing.

This article is designed to acquaint the economist with the law of water use and allocation, covering uses approved by riparian rights and rights of prior application and the situations in which the law has ascribed relative values to competing uses or classes of uses. The legal concepts of reasonable, riparian use and beneficial purpose of appropriation act as only a slight check on water users, while the newer concept of reasonable beneficial use shows an awareness of the economic relativity of specific uses, and the comparative benefits to be realized from different competing uses. However, the preference statutes should be overhauled, giving priority to uses for human life and health, then irrigation and industrial consumption, and finally such things as power and water transportation, for which substitutes can be found. When water is taken from one beneficial use for another, an economic loss occurs, which is less in the case of true preference than in condemnation. However, balky investors may weigh against true preference, since such enterprises are dependent on unstable water rights. Although law serves to balance progress and protection of rights, the future is more dependent on economists, engineers and administrators; thus far, water law has been the handmaiden of progress. (Murphy-Rutgers)
W69-09979

GROUNDWATER LEGISLATION,
Economic Research Service, Washington, D.C. Economics Div.
Wells A. Hutchins.
IN Economics and Public Policy in Water Resource Development, by Ames, Iowa State University Press, p 293-316, 1965. 24 p, 99 ref. Edited by Stephen C. Smith and Emery N. Castle.

Descriptors: *Public health, *Surface waters, *Flow, *Groundwater, *Water law, *Water rights, *Percolating water, *Riparian rights, Watercourses, Reservoirs, Legislation, Water utilization, Pumping, Drilling, Streams, Taxes, Water pollution, Water supply, Economic feasibility.
Identifiers: *Public opinion, *Public control, Yield, Hydrologists.

This article deals with water rights laws as applied to all water in the ground that is free to move by gravity and to enter wells, and is capable of being extracted from the ground and susceptible to practicable legal control. Groundwater legislation differentiates between percolating waters and definite underground streams; in some areas this distinction has been done away with due to hydrologists' objections. Public opinion has militated against some groundwater legislation, notably drilling and individual pumping clauses, even when they were obviously economically desirable, resulting in serious disputes about the economic feasibility of public control of groundwater rights under appropriation

statutes. However, with the advent of increases in development, it has become increasingly necessary to use the resources of group organizations and public agencies. High court decisions have indicated an increased awareness of the delicate problem of balancing protection of private rights and the public interest in water law cases concerning groundwater. (Murphy-Rutgers)
W69-09981

WATERWAYS AND MILLDAMS.

Ky Rev Stat Ann secs 182.010-182.030, 182.130, 182.140 (1963).

Descriptors: *Kentucky, *Dam construction, *Piers, *Bulkheads, Navigable waters, Hydroelectric plants, Federal government, Navigation, Dams, Roads, Boats, Abatement, Legislation, United States, Docks, Saw log test, Streamflow, Barriers, Riparian rights, Navigable rivers.
Identifiers: Houseboats.

No person shall place a dam or obstruction below ten miles from the head of a stream which is navigable for the running of push boats or the floating of sawlogs, staves, or ties. Owners shall remove such existing dams or obstructions as are not erected in accordance with the statutes. This section shall not apply to dams constructed for the purposes of generating electricity for distribution and sale. Any landowner may erect a wharf on his land, or a pier or bulkhead in the watercourse opposite his land. If such wharf, pier, or bulkhead obstructs navigation or injures the private rights of others, the county court may abate it. Persons may petition to erect a wharf at or on any public road. The court may then grant the privilege and fix conditions and limitations and the rates and charges for wharfage. County fiscal courts may indemnify the United States for damages caused by federal improvements. With the exception of steam vessels, all watercraft used as residences upon any navigable watercourse must be licensed. (Marsee-Fla)
W69-10008

TENNESSEE TOMBIGBEE WATERWAY DEVELOPMENT COMPACT.

Ky Rev Stat Ann secs 182.300-182.320 (1963).

Descriptors: *Kentucky, *Water resources development, *Tennessee River, *Interstate compacts, Legislation, Interstate rivers, Interstate commissions, Rivers, Project planning, Financing, Water conservation.

The governor of the commonwealth may execute a compact with other states for the development of a navigable waterway connecting the Tennessee and Tombigbee Rivers. The party states establish a joint agency known as the Tennessee-Tombigbee Waterway Development Authority. The Authority shall promote and coordinate the efforts of the party states to secure development of the Tennessee-Tombigbee waterway. The Authority may hold hearings, make reports, cooperate with other public or private groups having an interest in waterways development, formulate and execute plans and policies for the compact, and exercise such other powers as may be appropriate to accomplish its functions. Each party state shall furnish funds necessary for the operations of the Authority. Contributions will not be required from Kentucky beyond the amount necessary to pay the expenses of the Kentucky members of the Authority. The powers provided for in the compact are granted to the governor and to the members of the Authority for Kentucky. (Heckerling-Fla)
W69-10010

DAMS.
Vt Stat Ann tit 10, secs 701-719 (1958), as amended, (Supp 1968), 721 (Supp 1968).

Descriptors: *Vermont, *Dams, *Administrative agencies, *Dam construction, Legislation, Legal aspects, Jurisdiction, Water law, Water policy, Water control, Water storage, Dam failure, Dam design, Damsites, Hydroelectric plants, Salmon, Fish management, River regulation, Local governments, State governments, Federal government, Flood control.

The Vermont Water Resources Board has jurisdiction over all dams within the state, except for dams which relate to generation of electric power and fall under the auspices of the Public Service Board. Applications for construction and repair of dams are filed with the selectmen of the town in which the dam is located and with the fish and game commission. Upon a finding by such commission that the propagation of salmon will not be adversely affected, the application is certified to the appropriate agency having jurisdiction for public hearing. The state hydraulic engineer periodically inspects construction progress to insure that approved plans are carried out properly. There is provision for investigations and hearings in reference to the safety of any dam, and necessary action to correct deficiencies may be taken. It is state policy to cooperate with the federal government in flood control efforts, and funds received from the United States for property acquired by it for flood control purposes will be paid to the local government where such property is located. (Johnson-Fla)
W69-10027

PUBLIC WATERSHED ASSOCIATIONS.
For primary bibliographic entry see Field 04D.
W69-10028

PUBLIC WATERSHED ASSOCIATIONS.
For primary bibliographic entry see Field 04D.
W69-10029

PUBLIC WATERSHED ASSOCIATIONS.
For primary bibliographic entry see Field 04D.
W69-10030

PUBLIC WATERSHED ASSOCIATIONS.
For primary bibliographic entry see Field 04D.
W69-10031

DEPARTMENT OF WATER RESOURCES.
Vt Stat Ann tit 10, secs 571-576 (1958), as amended, (Supp 1968), 575a, 575b, 577-579 (Supp 1968).

Descriptors: *Vermont, *Water conservation, *Administrative agencies, *Water policy, Water law, Legal aspects, Legislation, Water pollution, Water resources, Water resources development, Local governments, State governments, Federal government, Watershed management, Water supply, Water utilization, Interstate compacts, New England Interstate WPS Compact, Flood control, Recreational use, Jurisdiction.

It is state policy that water resources be regulated and controlled in the public interest. The creation of the Vermont water resources board, the advisory commission appointed under the New England interstate water pollution control compact, and other advisory councils is necessitated thereby. The main duty of the Vermont water resources board is the supervision of state water resources including study and investigation of state streams and their basins, cooperation with state soil and water conservation districts, supervision over flood control, encouragement of recreational uses of water, and prevention of water pollution. The water resources department carries on a continuing study of groundwater in the state. The water resources board cooperates with federal and state governments in the interest of state water resources and is the agency of the state which aids municipalities in the development of local water supplies. Board members or their agents may enter upon private lands for the purpose of inspecting and investigating conditions relating to water pollution. (Johnson-Fla)
W69-10032

WHARF LINES AND BULKHEADS.
Del Code Ann tit 23, secs 1501-1511 (1953), as amended, (Supp 1966).

Descriptors: *Delaware, *Docks, *Bulkhead line, *Landfills, Land forming, Bulkheads, Piers, Piles (Foundations), Coastal structures, Land, Land development, Legislation, Water law, Water policy, Legal aspects, Land management, Shore protection, Riparian land, Riparian rights, Competing uses, Relative rights, Water utilization.

The City Council of New Castle has the power to limit the length of wharves and require such sluice ways as are deemed necessary; violators may be fined and their wharves subject to removal. Similar provisions extend to areas on the Laurel River except that the Levy Court of Commissioners of Sussex county hears complaints concerning violation of wharf line restrictions. Such restrictions apply to all wharves, platforms, landing places, marine railways, piers, piles, and abuttments which lie within the restricted areas. The town of Laurel is not prevented in any way from constructing proper sluices, culverts, and waste ways for the drainage of the town. Filling may not be done between certain points established by this section beyond established bulkhead lines. Except for duly authorized piers, no structure is allowed beyond bulkhead lines. Littoral proprietors may fill from their shore to the bulkhead lines established by this section, and title to such fill vests in the owners in fee simple. Disputes over new water frontage subsequent to filling to the bulkhead line are settled by the attorney general. (Johnson-Fla)
W69-10033

SEWAGE DISPOSAL SYSTEMS ON ISLANDS.
NH Rev Stat Ann secs 149-C:1 thru 149-C:7 (Supp 1967).

Descriptors: *New Hampshire, *Sewage disposal, *Islands, *Regulation, Administrative agencies, Water pollution control, Water pollution abatement, Fresh water, Ponds, Marshes, Landfills, Construction, Zoning, Permits, Cities, Planning, Legislation, Legal aspects, Sewage.
Identifiers: *Enforcement, Fines, Great ponds.

In order to prevent pollution of public waters, any person proposing construction of a sewage disposal system on any island surrounded by fresh water shall submit plans for the system for approval in accordance with zoning ordinances, or if such ordinances are not applicable such plans shall be submitted to the Water Pollution Commission for approval. No sewage system shall be constructed without written approval. No person shall fill a marsh bordering on a great pond in order to erect a building thereon without written approval from the appropriate authority. The Water Pollution Commission shall administer and enforce this act. The Commission may issue cease and desist orders to halt unauthorized construction or use of sewage systems on islands. Any person failing to obey commission orders shall be fined up to $500 for each day of violation. (Harris-Fla)
W69-10034

WATER POLLUTION AND DISPOSAL OF WASTES.
For primary bibliographic entry see Field 05B.
W69-10035

WATER POLLUTION AND DISPOSAL OF WASTES.
For primary bibliographic entry see Field 05B.
W69-10036

WATER POLLUTION AND DISPOSAL OF WASTES.
For primary bibliographic entry see Field 05B.
W69-10037

WATER POLLUTION AND DISPOSAL OF WASTES.
For primary bibliographic entry see Field 05B.
W69-10038

FUTURE SUPPLIES OF WATER FOR DOMESTIC USE.

NH Rev Stat Ann secs 148-A:1 thru 148-A:5 (1964), as amended, (Supp 1967).

Descriptors: *New Hampshire, *Domestic water, *Planning, *Water supply, Water sources, Cities, Administrative agencies, Public health, Legislation, Potable water, Water resources development, Future planning, Long-term planning, Human population, Legal aspects.

There is a state-wide need for long-range planning to insure adequate water supplies for domestic use. The Department of Health and Welfare, Division of Public Health Services, is authorized to study future domestic water supply requirements of cities appearing to have increased industrial and population growths in the next 50 years. The most feasible sites for sources of water shall be determined by the study. The Division may employ engineers and other assistance to aid in the studies. Studies shall be reported to the state legislature with recommendations for acquisition of future sites. Upon request, the Division shall consult with and give advice to any municipality considering a change in its domestic water supply due to an approaching critical situation. (Harris-Fla)
W69-10039

TESTING OF WATER SUPPLIES.
NH Rev Stat Ann sec 131:3 (1964).

Descriptors: *New Hampshire, *Public health, *Water sources, *Regulation, Administrative agencies, Water quality, Water supply, Recreation, Water purification, Domestic water, Potable water, Public utilities, Legislation, Schools, Investigations, Inspection.

The Department of Health and Welfare Division of Public Health Services shall make periodic inspections, analyses, and investigations of public water supplies. When requested or deemed necessary, the Board of Health may also inspect and analyze sources furnishing water to institutions, schools, hotels, camps, and other public resorts. The Board shall enforce laws pertaining to water supply and sanitation of public waters. (Harris-Fla)
W69-10040

WATERCOURSES AND CUTS GENERALLY.
SC Code Ann secs 70-163, 70-164 (1962), as amended, (Supp 1968).

Descriptors: *South Carolina, *Condemnation value, *Condemnation, *Inland waterways, Land tenure, Compensation, Financing, Local governments, Legal aspects, Legislation, Docks, Shores, Eminent domain, Land use.
Identifiers: *Tolls.

The owner of the shore of, or any wharf in or over, the navigable streams of the state may charge reasonable tolls for the use thereof. If necessary to acquire a right of way or outlet in, over, or through any land for construction of inland waterways, and the county and owner cannot agree on the price of the land, condemnation proceedings shall be instituted pursuant to article 9, section 20 of the Constitution of 1895, and the applicable statute. Compensation shall be paid from the general county fund when approved by a majority of the county legislative delegation. Condemnation proceedings are appealable. (Harris-Fla)
W69-10041

RULES OF THE INTERNAL IMPROVEMENT FUND OF THE STATE OF FLORIDA SOVEREIGNTY SUBMERGED AND TIDAL LANDS IN COASTAL AND INTRACOASTAL WATERS.

Fla Admin Code Chap 200-2 (1968).

Descriptors: *Florida, *Regulation, *Intertidal areas, *Bulkhead line, Legislation, State jurisdiction, Riparian rights, Public rights, Tidal water, High water mark, Low water mark, Islands, Sandbars, Shallow water, Tides, Recreation, Docks, Dredging, Jetties, Legal aspects, Administrative agencies.
Identifiers: Tidal lands.

Sovereignty submerged and tidal lands include such areas of the bottom lands of meandered fresh waters connected with or flowing into coastal and intracoastal navigable waters as are subject to tidal flow. Criteria to be considered in establishing or altering the bulkhead line are: (1) free use of public waters; (2) recommendations of the state board of conservation; (3) upland erosion, shoaling of channels, accretion, and tidal currents; (4) effects on adjacent or nearby upland property values; (5) natural beauty; (6) beach erosion control; (7) general area problems. Commitments for public rights-of-way shall conform to the regulations set forth herein. Commitments of sovereignty lands for limited or restricted uses are considered by the trustees. Bulkhead line establishment and permit acquisition is a prerequisite to corporate filling of sovereignty lands. Material from sovereignty lands used to fill private land and upland must be purchased. (Moulder-Fla)
W69-10042

CANALS AND WATERWAYS, RIVERS, LAKES, STREAMS.

Ill Ann Stat ch 19, secs 52-78 (Smith-Hurd 1963), as amended, (Supp 1969).

Descriptors: *Illinois, *Administrative agencies, *Riparian rights, *Navigable waters, Local governments, State governments, Permits, Non-navigable waters, Navigation, Encroachment, Docks, Channels, Data collections, Drainage, Construction, Reclamation, Beds, Harbors, Electric power, Natural resources, Legislation, Great Lakes, Water levels, Regulation.

The Department of Public Works and Buildings has jurisdiction over all Illinois lakes and streams in which the state has any rights or interests. The department shall investigate every encroachment on public waters and hold hearings of complaints concerning the waters, navigation, docks or related topics. It shall gather data concerning deep waterways and navigable waterbodies and plan for the beautification of state waters. It shall furnish information to anyone desiring to reclaim land as to cost or feasibility. No structure or fill may be constructed upon public waters without first obtaining a permit from the department. The department, upon issuance of a permit, may allow the taking of minerals or substances from beds of public waters or the construction of harbors in certain areas. The department shall plan for the establishment of preserves for recreation along public waters. It shall gather data concerning water power, natural resources, propagation of fish, and flood control. It shall also establish water levels and require proper dam maintenance. Any drainage district, before increasing the flow of any stream, must obtain a permit from the department. (Darragh-Fla)
W69-10043

ILLINOIS WATERWAY.
Ill Ann Stat ch 19, secs 79-106 (Smith-Hurd 1963).

Descriptors: *Illinois, *Inland waterways, *Channels, *Construction, Powerplants, Water storage, Local governments, Maintenance, Condemnation, Bridges, Tunnels, Public utilities, Eminent domain, Damages, Legislation, Cities, Administrative agencies, Permits, Drainage systems, Operation and maintenance.

A deep waterway, to be known as the Illinois Waterway, shall be constructed from Chicago to the Illinois River. Construction, maintenance, and control is vested in the department of public works. The department is empowered: to prepare plans for construction; to use or lease excess water or power; to construct and maintain powerplants and water storage facilities; to establish and collect tolls; to prescribe rules and regulations; to acquire property by donation, purchase or condemnation; to enter upon and use all lands or water necessary; to repair, replace, or reconstruct public bridges; to sell equipment or land no longer needed; to allow public utilities or municipalities to use any tunnels constructed to contain power lines; to hire personnel; to apply for federal permits; and to make contracts. The department shall make compensation for any interference to private property taken or damaged through contract or eminent domain. The department may use public property. If any drainage system or bridge is interferred with during construction, it shall be repaired. The state is liable for damages to person or property resulting from the construction of or overflowing from the waterway. (Darragh-Fla)
W69-10044

ILLINOIS AND MISSISSIPPI CANAL-STATE PARK.
Ill Ann Stat ch 105 secs 482a-482d (Smith-Hurd Supp 1969).

Descriptors: *Illinois, *Canals, *Parks, *United States, Legislation, Lakes, Administrative agencies, Operation and maintenance, Conservation, Land tenure, Dams, Mississippi, Construction, Railroads, Bridges, Contracts, Recreation facilities, Water management (Applied), Easements, Legal aspects.

The Department of Conservation and the Department of Public Works and Buildings are authorized to enter into agreements with the United States to allow the United States to acquire title to the lands in the lake created by the government dam constructed across Rock River and in all other lands upon which the United States has rights or easements used for the purpose of the Illinois and Mississippi Canal. The Department of Conservation may accept a quitclaim deed from the United States to all right, title, and interest of the United States in the canal. Upon the acceptance of the title, and canal shall become a State Park under the care, control, supervision, and management of the Department of Conservation. This control is subject to certain enumerated exceptions. (Heckerling-Fla)
W69-10045

POWER TO ACQUIRE PIERS AND BEACHES.
Ill Ann Stat ch 24, sec 11-93-1 (Smith-Hurd 1962).

Descriptors: *Illinois, *Eminent domain, *Recreation facilities, *Cities, Legislation, Beaches, Piers, Navigable waters, Public benefits, Land tenure, Land use, Legal aspects.

The corporate authorities of each municipality may acquire by eminent domain private lands bordering upon public or navigable waters which are useful or desirable for bathing beaches and recreation piers. (Heckerling-Fla)
W69-10046

LEVEE IMPROVEMENT COMMISSION.
Ill Ann Stat ch 24, secs 11-114-1 thru 11-114-3 (Smith-Hurd 1962).

Descriptors: *Illinois, *Levees, *Administrative agencies, *Cities, Legislation, Bonding, Navigable waters, Lakes, Shores, Rivers, Parks, Operation and maintenance, Facilities, Local governments, Legal aspects.
Identifiers: *Improvements.

The corporate authorities of a municipality with a population of less than one-half million which is bounded by or through which flows a river or is contiguous to or contains within its corporate limits a portion of a navigable lake may provide for the creation of a levee improvement commission. Such commission has full control and supervision of all improvements, docks, levees, industrial developments and facilities including terminals and parks on the river front or lake shore and the land, whether developed or undeveloped approximate to the river front or lake shore located within the corporate limits of the municipality. Such commission may expend money over which it has control for the construction, operation, or maintenance of improvements, docks, levees, industrial developments, and facilities, including terminals and parks on the river front or lake shore or for land over which the commission has control. The corporate authorities may issue bonds for the purposes authorized. (Heckerling-Fla)
W69-10047

STATE AID IN FLOOD CONTROL; MUNICIPAL-FEDERAL FLOOD CONTROL PROJECTS.

Ill Ann Stat ch 24, secs 11-115-1, 11-115.1-1 (Smith-Hurd 1962), as amended, (Supp 1969).

Descriptors: *Illinois, *Federal government, *Contracts, *Flood control, Cities, Legislation, Administrative agencies, Regulation, Bridges, Pollution abatement, Flood protection, Easements, Right-of-way, Damages, Construction, Projects, Operation and maintenance, Construction costs, United States, Flood routing, Waste dumps, Landfills.

Whenever the state appropriates money for the construction of works to protect against floods, the authorities of any municipality benefited may contract with the state to take over and maintain the works. Any city may contract with the United States that with reference to any flood control project constructed by the United States it will: (1) provide lands, easements, and rights-of-way without cost, (2) contribute part of the construction costs, (3) hold and save the United States free and harmless from claims of damages resulting from such construction, (4) maintain and operate all works after completion, (5) establish and enforce flood channel limits for protection of any flood channel, (6) prevent dumping of waste material or the creation of fills within any flood channel limits, and (7) regulate the construction of bridges or other structures crossing any waterway. (Heckerling-Fla)
W69-10048

WATER SERVICE DISTRICT.

Ill Ann Stat ch 111 2/3, secs 213-222.1 (Smith-Hurd 1966), as amended, (Supp 1969).

Descriptors: *Illinois, *Water districts, *Local governments, Cities, Taxes, Tax rate, Costs, Financing, Compensation, Legislation, Boundaries (Property), Governments, Water supply, Contracts.
Identifiers: Water mains.

Nonincorporated areas may be incorporated as a water service district upon petition, notice and hearing before the county judge. The voters in the proposed district must approve the incorporation. The board of trustees are appointed to manage the district, sell water, and pass ordinances necessary for the management of the district. The board may contract to furnish water to adjacent incorporated towns or public utilities and may install mains to furnish water to the district. Bond issues will be passed by the voters and financed by an annual tax. Adjoining territory may be annexed if approved by the voters. Adjoining land owners can be disconnected from the district. (Darragh-Fla)
W69-10049

MUNICIPAL BRIDGES, FERRIES, AND TERMINALS.

Ill Ann Stat ch 121, secs 10-601 thru 10-604 (Smith-Hurd 1960).

Descriptors: *Illinois, *Cities, *Bridges, *Boats, Legislation, Operation and maintenance, Construction, Bonding, Regulation, Rivers, Boundaries (Surfaces), Facilities, Transportation, Legal aspects.
Identifiers: *Ferries.

The corporate authorities of any municipality have the power to acquire by purchase, lease, or gift, ferries, bridges, the approaches thereto, and land adjacent to each ferry or bridge. Each municipality has certain powers with regard to: (1) the acquisition and maintenance of the ferries and bridges; (2) rivers forming the boundary line of this state; (3) aiding road districts; (4) issuing bonds; and (5) collecting tolls. Every bridge and ferry and also approaches thereto which are controlled by the municipality are subject to municipal control or ordinances the same as though the bridge or ferry were situated within the corporate limits of the municipality. Every municipality of less than 500,000 inhabitants which is located on a navigable stream has the power to acquire, construct, maintain, and operate either within or without its corporate limits bridges and approaches, and transportation and other terminal facilities. (Heckerling-Fla)
W69-10050

STATE HIGHWAYS.

Ill Ann Stat ch 121, secs 4-201, 4-201.9, 4-201.13 (Smith-Hurd 1960).

Descriptors: *Illinois, *Highways, *Bridges, *Administrative agencies, Legislation, Construction, Operation and maintenance, Navigable waters, Streams, United States, Contracts, Leases, Rivers, Transportation, Bridge construction.
Identifiers: *Ferries.

The Department of Public Works and Buildings shall have the power (1) to construct, purchase, lease or otherwise acquire, and (2) to operate without charge to the public, ferries over rivers and other waters upon any state highway, whether permanently or temporarily located, until such time as it is deemed feasible and desirable to construct bridges at such places. The Department may also construct, maintain, and operate bridges across any stream between this state and any adjoining state where bridge is necessary to connect the federal-aid highway network in this and such adjoining state and enter into agreements with adjoining states, persons, and the United States government in conjunction therewith. (Heckerling-Fla)
W69-10051

EMINENT DOMAIN.

Iowa Code Ann secs 471.11 to 471.14 (1949).

Descriptors: *Iowa, *Eminent domain, *Condemnation, *Diversion, Legislation, Alteration of flow, Legal aspects, Land tenure, Railroads, Overflow, Dams, Reservoirs, Streams, Excavation, Channels, Ditches, Administrative agencies, Water users, Access routes, Public utilities.

Lands which are sought to be condemned for water stations, dams, or reservoirs, including all overflowed lands, shall, if requested by the owner, be set aside in a square or rectangular shape by the state commerce commission. An owner of land which has been condemned shall not be deprived without his consent of access to the water or use thereof, in common with the water company, on his own land nor, without his consent shall his dwelling, outhouses, or orchards be overflowed or otherwise injuriously affected by such condemnation. A railroad which has the right to excavate a channel and thereby change the course of a stream may by condemnation or otherwise acquire sufficient land on which to excavate such ditch or channel. Nothing in the above section shall give such railroad the right to change the course or any stream or watercourse where such right does not otherwise exist nor without the owners' consent to divert such stream from any cultivated land when it only touches such lands at one point. (Heckerling-Fla)
W69-10052

STATE CONSERVATION COMMISSION.

Iowa Code Ann sec 107.21, 107.24 (1949), as amended, (Supp 1969).

Descriptors: *Iowa, *Conservation, *Administrative agencies, *Fish, Fish conservation, Legislation, Regulation, Condemnation, Leases, State governments, Public benefits, Fish hatcheries, Fish management, Fish stocking, Fisheries.

The department of conservation shall consist of the following divisions: (1) a division of fish and game which shall include matters relating to fish and fisheries; (2) a division of lands and waters which shall include matters relating to state waters, lakes and streams; and (3) a division of administration. The State Conservation Commission is authorized to: (1) acquire by purchase, condemnation, lease, gift and devise lands or waters suitable for the following purposes: (a) public fishing grounds and waters to provide areas in which any person may fish in accordance with the law and (b) fish hatcheries, fish nurseries, game farms and fish refuges; (2) extend and consolidate waters suitable for the above purposes by exchange for other waters; (3) capture, propagate, buy, sell, or exchange any species of fish needed for stocking the lands or waters of the state; and (4) control by shooting or trapping any fish for the purpose of preventing the destruction of or damage to private or public property. (Heckerling-Fla)
W69-10053

PUBLIC USE OF PRIVATE LANDS AND WATERS.

Iowa Code Ann secs 111C.1-111C.7 (Supp 1969).

Descriptors: *Iowa, Recreation, Land tenure, Public benefits, Damages, Legal aspects, Legislation, Recreational facilities, Water utilization, Water resources development.
Identifiers: Liability.

The purpose of this chapter is to encourage private owners of land to make land and water areas available to the public for recreational purposes by limiting their liability toward persons entering thereon for such purposes. Except as otherwise provided, a landowner owes no duty of care in keeping premises safe or warning of dangerous conditions to persons entering for recreational purposes. Persons entering land for recreational purposes without charge shall not be considered invitees or licensees. Liability lies against a landowner when he willfully and maliciously fails to guard or warn against a dangerous condition or when he charges the persons entering on his land for the recreational use thereof. (Heckerling-Fla)
W69-10054

WATER RECREATIONAL AREAS.

Iowa Code Ann secs 111.59-111.78 (Supp 1969).

Descriptors: *Iowa, *Recreation facilities, *Cities, *Water resources development, Legislation, Legal aspects, Public benefits, Permits, Contracts, Condemnation, Financing, Drainage districts, Conservation, Administrative agencies, Levees.
Identifiers: *Water recreational areas.

Municipalities may establish water recreational areas and when established without state funds, the municipality shall have exclusive control of such areas. Municipalities must petition the state conser-

vation commission in order to establish a water recreational area without public funds. Any lake in the water recreational area shall be permanently subject to and available for free public access use. The state conservation commission shall keep a record of all permits granted and issued by it showing when and to whom issued and the location of the proposed water recreational area. If a municipality cannot acquire land necessary for the area at a reasonable price, they may condemn such land. Such condemnation shall be limited to land and interests which will be permanently subject to and available for free public access and use or will be required for dam or other facilities necessary for the water recreational area. The county boards and trustees having control of any levee or drainage district established thereunder may enter into contracts and agreements with municipalities authorized to establish water recreational areas under the provisions of this act. (Heckerling-Fla)
W69-10055

BRIDGES.

Iowa Code Ann secs 381.1, 381.9-381.20 (1949), as amended, (Supp 1969), sec 381.7 (Supp 1969).

Descriptors: *Cities, *Bridges, *Construction, *Iowa, Repairing, Culverts, Tax, Tax rate, Legislation, Bridge construction, Railroads, Rivers, Navigable waters, Local governments, Contracts, Legal aspects.

Cities have the care, supervision, and control of all public bridges, culverts, and viaducts within their corporate limits and which are not owned by any railroad. They may also aid in the construction of county bridges within the city limits or bridges across any unnavigable river dividing the county from another state. Cities may also vote to aid in the construction of county bridges or bridges across a navigable boundary river of the state. A city of 5,000 population or more may, after proper notice, vote a tax to finance the construction of any desired bridge. Cities are empowered to contract with any railroad, corporation, or person who privately owns a bridge for its use as a public bridge. Such a contract may be financed by a tax which may be secured by a bond issue. (Darragh-Fla)
W69-10056

WATER SUPPLY, DRAINAGE AND FLOOD CONTROL.
Ill Ann Stat ch 34, secs 3101-3114 (Smith-Hurd 1960), as amended, (Supp 1969).

Descriptors: *Illinois, *Water control, *Flood control, *Drainage, Water supply, Local governments, Administrative agencies, Federal government, Financing, Contracts, Ditches, Levees, Dikes, Reservoirs, Rivers, Streams, Sewage, Sewers, Basins, Water works, Taxes, Water rights, Water pollution, Flow control, Sewage disposal.

The board of supervisors of any county contiguous with another county of 1,000,000 or more population may establish a department of public works to supervise projects dealing with water supply, drainage, and flood control. A tax levy passed by the voters in the interested county will provide funds. In order to protect, reclaim or irrigate county land the county board may improve any existing water facility and purchase or condemn any publicly or privately owned facility necessary for the proposed plan. The board may control the flow of rivers within county boundaries if such control does not interfere with vested water rights. A city lacking its own water works program may pass an ordinance allowing it to contract with the county for water. The county board has the power to acquire land, build dams and reservoirs, sink wells, purify water, and establish rates for the use of water. The board may also regulate the disposal of sewage and construct and maintain sewers. The county board may contract with federal agencies located within the county. (Darragh-Fla)
W69-10057

UNITED STATES V 930.65 ACRES OF LAND IN JEFFERSON COUNTY (VALUATION OF LAND WITHOUT WATER SUPPLY).
299 F Supp 673-679 (DC Kan 1968).

Descriptors: *Condemnation value, *Eminent domain, *Property values, *Water values, Market value, Assessments, Land tenure, Access routes, Projects, Flood control, Water control, Legal aspects, Judicial decisions.
Identifiers: Development land, Land valuation.

Plaintiff United States initiated condemnation proceedings to take a portion of defendant's land for flood control purposes in the Missouri River basin. The value of defendant's pasture land before taking was $100 per acre, and the Commission found no decrease in value for the 34.85 acres remaining after the taking. Defendant landowner contended the land was still pasture and was merely of nominal value after the taking, while the Commission contended the remainder was development land. The United States district court recognized that the remaining land was left inaccessible and without water or suitable pond site and held that the Commission finding was erroneous and based upon an improper rule of valuation which measured compensation by the difference between the market value unenhanced by the project and the market value of the remainder including enhancement by the project. The court noted the correct rule to be that compensation includes the incidental injury or benefit to the part not taken. The court held the possibility of land development to be remote and speculative and not sufficiently certain of realization to be considered an enhancement of the property. (Harris-Fla)
W69-10058

BROWN V ELLINGSON (WITHDRAWAL OF LAKE WATER).

224 So2d 391 - 395 (DCA Fla 1969).

Descriptors: *Florida, *Withdrawal, *Lakes, *Water levels, Legislation, Judicial decisions, Water level fluctuations, Riparian rights, Canals, Ditches, Pumping, Drainage, Recreation, Shores, Legal aspects, Water law.
Identifiers: Injunctions (Prohibitory).

Plaintiff sought to have defendants enjoined from drawing water from a lake greater than two square miles in area. Defendants failed to obtain the written consent of abutting landowners as required by Florida Statute. Plaintiff further alleged that defendants thereby infringed upon his common law rights as a riparian owner by lowering the water level of the lake so as to expose the lake bottom. The trial court held that the statute did not apply because its terms were limited to situations where the lowering of the water level was caused by a drainage canal or ditch. The appellate court held that the complaint had stated a cause of action pursuant to the statute and that plaintiff was only required to show that the level of the lake had been lowered below its normal level as a direct result of defendants' pumping operations. The court was also of the opinion that plaintiff's complaint stated a cause of action in stating that his common-law riparian rights had been violated. (Heckerling-Fla)
W69-10059

LEGAL ASPECTS OF CROSS CONNECTION INSPECTIONS,
Ernest H. Campbell.
Am Waterwks J, Vol 61, No 8, p 409-412, Aug 1969. 4 p, 11 ref.

Descriptors: *Plumbing, *Pipes, *Inspection, *Potable water, Disposal, Domestic wastes, Judicial decisions, Regulation, Control, Water pollution, Water pollution control, Public health, Water quality control, Water supply.
Identifiers: *Cross connections.

Cross connections in pipelines are connections where safe water inadvertently comes into contact with contaminating fluids. Liability problems arise from the use or consumption of this unsafe water. Often the supplier does not have access to all pipes that may contain potential cross connections. However, this in many cases will not free him from liability for injury. Inspection of all pipes within a water system is essential to protect users from harm. In order to gain access to all pipelines, there may be a need to resort to search warrants. Recent Supreme Court decisions have affected the area of warrantless searches, and it is now fairly clear that warrants are required if entrance for such inspections is refused. Cross connections should be eliminated where possible, or at least minimized and rigorously inspected so as to safeguard against the spread of disease. (Darragh-Fla)
W69-10060

WATER DRAINAGE AND LEVEE DISTRICTS.

Ark Stat Ann secs 21-801 thru 21-858 (1968).

Descriptors: *Arkansas, *Drainage districts, *Flood control, *Administrative agencies, Project planning, Federal government, Drainage systems, Project purposes, Channel improvement, Diversion structures, Flood protection, Levees, Watershed management, Legislation, Legal aspects, Drainage, Drainage programs, Easements, Condemnation, Eminent domain, State governments.

The board of directors of any levee or drainage district is authorized by statute to contract with the federal government concerning drainage and flood control projects. The board is granted certain operational powers, including the power to provide land or servitudes over land for projects. The increased value of land, by reason of the construction of a project, is determined by each district's board of assessors, and taxes are assessed accordingly. The procedures by which assessments are made and collected and grievances are settled are set forth. The boards of directors of the districts are generally responsible for maintaining their drainage and flood control projects in good repair. The flood control and drainage projects authorized by the state legislature may be consolidated by the districts with the local projects for which they were originally created. The powers and duties of the districts regarding the general projects are the same as those associated with the original local projects. (Kelly-Fla)
W69-10061

WATER DRAINAGE AND LEVEE DISTRICTS.
Ark Stat Ann, secs 21-801 thru 21-809 (1968).

Descriptors: *Arkansas, *Drainage districts, *Flood control, *Project planning, Federal government, Drainage systems, Administrative agencies, Project purposes, Diversion structures, Flood protection, Levees, Watershed management (Applied), Legislation, Legal aspects, Drainage programs, Easements, Condemnation, Eminent domain, Mississippi River, Contracts, Highways, Reservoirs, Public benefits, Assessments.

Improvement district commissioners shall be elected from all combination levee and drainage districts which embrace all the lands within the corporate limits of a city. The board of directors of any levee or drainage district is authorized to contract with the federal government concerning any flood control or drainage project on the Mississippi River or its tributaries. The board may acquire land or servitudes over land in discharge of such obligations. Condemnation may be used by the board in acquiring land. The governor and secretary of state may convey to the board of any district, or to the federal government, rights of way for levees, levee foundations, channel rectifications, reservoirs, reservoir sites, spillways, drainage canals, and easements for flowage and storage rights over state lands. The highway commission shall make similar grants if flood control or drainage works contemplated by the district or by the federal government will extend across state highways. The state govern-

ment consents to the use of eminent domain by the United States for acquisition of land, flowage rights, and easements for authorized federal projects. (Kelly-Fla)
W69-10062

WATER DRAINAGE AND LEVEE DISTRICTS.
Ark Stat Ann, secs 21-810 thru 21-827 (1968).

Descriptors: *Arkansas, *Drainage districts, *Flood control, *Project planning, Drainage systems, Project purposes, Diversion structures, Flood protection, Levees, Watershed management (Applied), Legislation, Legal aspects, Drainage programs, State governments, Construction, Assessments, Construction costs, Contracts, Federal government, Bayous, Cost-benefit analysis, Cost-benefit ratio.

The board of assessors of each levee or drainage district, in which flood control and drainage works may be constructed, is empowered to determine and record the increase in value accruing to all real property within the district by reason of the construction. The assessment is subject to review by the equalization board and by the chancery court. The statute outlines the procedures by which assessments are made and collected and by which grievances are settled. Before a district can exercise the powers conferred by the statute, it must provide an outline of the project being undertaken and secure the approval of the board of directors and of the district's landowners. The district is authorized to execute all proper contracts with the United States to provide lands, rights of way, and easements necessary for straightening, cleaning out, and deepening bayous that serve as natural drainage for such district. The board of directors must first determine, however, that the benefits of the proposed work are general to the whole district and that the benefits are equal to the costs. (Kelly-Fla)
W69-10063

WATER DRAINAGE AND LEVEE DISTRICTS.
Ark Stat Ann, secs 21-827 thru 21-858 (1968).

Descriptors: *Arkansas, *Drainage districts, *Flood control, Project planning, Federal government, Drainage systems, Administrative agencies, Project purposes, Channel improvement, Diversion structures, Flood protection, Levees, Watershed management (Applied), Legislation, Legal aspects, Drainage programs, Easements, Condemnation, Eminent domain, State governments, Construction costs, Construction, Contract administration, Ditches, Watershed management, Operation and maintenance, Repairing.

When any levee or drainage district has given assurances to the federal government that the district will maintain and manage a drainage facility constructed by the United States, the board of commissioners of the district is responsible for carrying out such management. The Corps of Engineers may file written objections with the officers of any district which fails to comply. If the district fails to act, the state attorney general may bring a mandamus action in the appropriate court. The board of commissioners of any drainage district may purchase or rent such machinery and equipment as is needed in repairing, deepening, or clearing ditches or levees in its district. The flood control and drainage projects authorized by the state legislature in general acts (1949) may be consolidated by the drainage and levee districts with the projects for which they were originally created. The duties, obligations, and powers attendant to the original projects may be consolidated by the districts with those associated with the general acts. (Kelly-Fla)
W69-10064

ARKANSAS IRRIGATION, DRAINAGE AND WATERSHED IMPROVEMENT DISTRICT ACT OF 1949.
Ark Stat Ann secs 21-901 thru 21-934 (1968).

Descriptors: *Watershed Protection and Flood Prevention Act, *Arkansas, *Irrigation districts, *Drainage districts, Legislation, Administrative agencies, Taxes, Tax rate, Operating costs, Assessments, Boundaries (Property), Contracts, Bonding, Flood control, Sediment control, Construction, Benefits, Damages, Project benefits, Flood damage, Operation and maintenance.
Identifiers: Watershed district.

This act provides for the organization, operation and maintenance of irrigation, drainage, and watershed districts for the general purposes of: (1) preventing erosion, flood water and sediment damages in river and stream watersheds; (2) establishing irrigation systems; (3) coordinating irrigation, flood control, and drainage improvements; and (4) cooperating with the federal government in furthering the objectives of the Watershed Protection and Flood Prevention Act. Procedures for the establishment of such districts and the specific purposes for which districts may be organized are set forth, as are procedures for establishing district boundaries. The governing body of each district is a board of commissioners possessing the powers herein enumerated. Provision is made for the assessment of benefits and damages accruing to landowners by reason of proposed improvements, and a tax levy is provided to pay the estimated cost of such improvements. Districts are also authorized to tax, to maintain proper service, to reassess benefits, to borrow money, to issue bonds, to control construction of improvements, and to enter contracts with the United States. Provisions for the extension of taxes, the time for payment of taxes, and the collection of taxes are included. (Marsee-Fla)
W69-10065

IMPROVEMENT DISTRICTS OF RIVER WATER - DRAINAGE AND LEVEE DISTRICTS.

Ark Stat Ann secs 21-1001 thru 21-1013 (1968).

Descriptors: *Arkansas, *United States, *Water management, *Drainage districts, Levees, Financing, Local governments, Legislation, Judicial decisions, Taxes, Tax rate, Assessments, Damages, Benefits, Eminent domain, Federal government, Legal aspects, Planning.

When the United States Congress has adopted an improvement plan for waters bordering on Arkansas, then 10 or more owners of real property within the adopted area may petition the circuit court to establish an improvement district. The circuit court shall hold a hearing to grant or deny the petition. This order is appealable. Commissioners shall be appointed by the court, and they shall assess benefits and damages to property owners. The court shall order a tax levy. The federal plan will be the plan used by the local district. The districts have full power to enter into a contract of assurance with the federal government and to perform all acts required by the federal government, to perform all acts required by the interested federal agencies, and to exercise the right of eminent domain. The districts thus organized shall have all the rights and powers of locally organized drainage and levee districts. (Darragh-Fla)
W69-10066

ARTESIAN WELLS.
Ark Stat Ann secs 21-1101 thru 21-1108 (1968).

Descriptors: *Arkansas, *Artesian wells, *Well regulations, *Water pressure, Legislation, Underground, Well spacing, Wells, Water wells, Subsurface waters, Pressure, Water sources, Confined water, Groundwater, Water supply, Water allocation (Policy), Water rights, Preferences (Water rights), Consumptive use, Legal aspects.

Any occupier of land who is dependent upon an artesian well for his domestic water supply, who finds that well pressure has become inadequate for his plumbing system, and who knows of an abandoned, unused well within one mile may file a complaint petition with the county judge. The judge serves notice of the complaint on the owner of the unused well, and if he does not seal it within ten days of notice, the judge will order it sealed. For those wells sealed by the county, a $100 expense statement will be filed with the recorder as a part of the deed for the land, and such deed cannot be recorded without payment of the expenses on record. This act is retroactive to cover wells abandoned prior to its passage. (Douberley-Fla)
W69-10067

WATER CONSERVATION COMMISSION.
Ark Stat Ann secs 21-1301 thru 21-1315 (1968).

Descriptors: *Arkansas, *Reservoir storage, *Dams, Legislation, Water storage, Retention, Surplus water, Water distribution (Applied), Water shortage, Water supply, Water control, Water management (Applied), Water allocation (Policy), Administrative agencies, Competing uses, Distribution, Equitable apportionment, Preferences (Water rights), Water contracts, Water consumption, Riparian rights, Detention reservoirs, Multiple-purpose reservoirs, Permits, Dam construction.

After notice and hearing, the Arkansas Soil and Water Conservation Commission may issue permits for construction of dams and allocate the taking of waters during shortages. Any person may be issued a permit if: (1) plans and specifications of construction and operation are submitted; (2) water is to be discharged to approximate flow without the dam; and (3) applicant has the right to occupy flooded lands. Permits cannot exceed 50 years and may be cancelled for non-compliance. The permit holder has exclusive rights to take water from the reservoir, except that the owner of land on which water is unlawfully impounded has a right to that water and may sue for damages. In case of water shortage, the Commission may allocate water to those affected in the following order of preference: uses 91) sustaining life, (2) maintaining health, and (3) increasing wealth. Any person may acquire rights to water in government reservoirs by contract, and notice of such intent to contract must be given to the Commission. The act does not cover natural lakes, rainwater, floodwater or springs on an individual's property. Yearly fees for permits and penalties for violations are provided. (Douberley-Fla)
W69-10068

WATER POWER COMPANIES.
Ark Stat Ann secs 73-2001 thru 73-2019.

Descriptors: *Arkansas, *Hydroelectric plants, *Dam construction, *Electric power production, Powerplants, Erection, Dams, Legislation, Damages, Compensation, Administrative agencies, Local governments, State governments, United States, Fish passages, Construction, Hydroelectric power, Legal aspects, Assessments, Taxes, Eminent domain.

All water power in the state is a part of the public domain. Any person or corporation can procure a charter from the state authorizing the erection of a dam across a stream or river for the purpose of producing electric power. An application for use of the power produced shall be made to the Railroad Commission, and said Commission at its discretion can require the applicant to construct a fish chute sufficient for easy passage of fish. The power shall be for public use and may be sold to private parties. If the power is to be used privately by the producer, he will be required to pay a tax for such use. The power of eminent domain may be exercised by such authorized corporations, and damages, assessment, and compensation will be established in the proper court. (Darragh-Fla)
W69-10069

INTERSTATE WATERSHED COOPERATION ACT.
Ark Stat Ann secs 21-1801 thru 21-1806 (1968).

Descriptors: *Arkansas, *Watershed management, *Water resources development, *Interstate compacts, Interstate commissions, Legislation, Administration, Administrative agencies, Flood control, Water conservation, Water utilization, Water sources, Water supply, Interstate, State governments, Federal government, Water policy, Equitable apportionment, Cost allocation, Cost sharing, Project planning, Cost repayment, Expenses, Damages, Maintenance costs.
Identifiers: Interstate cooperation.

Any watershed improvement district is authorized to cooperate with federal agencies and with other states in interstate watershed projects. These are projects that concern water lying wholly or in part outside the state but which will benefit property in the state and which are authorized by Congress for the prevention of flood water, erosion, and sedimentation damage, as well as conservation, development, utilization and disposal of water. All agreements must contain statements concerning obligations as to installation of works, share of maintenance and costs, share of damages, and share of any excess funds. To fulfill its obligations, any district may appropriate money, issue bonds and levy taxes. (Douberley-Fla)
W69-10070

POLLUTION OF STREAMS.
For primary bibliographic entry see Field 05G.
W69-10071

FLOOD CONTROL.

Ark Stat Ann secs 9-801 thru 9-811 (1956), as amended, (Supp 1967).

Descriptors: *Arkansas, *Flood control, *Flood routing, *Check structures, Dams, Dikes, Levees, Flood damage, Artificial watercourses, Natural streams, Water control, Flood forecasting, Flood protection, Diversion structures, Legislation, Legal aspects, Reservoirs, Easements, Eminent domain, Administrative agencies, Condemnation.

The Arkansas Soil and Water Conservation Commission is authorized to determine public policy with regard to flood prevention, flood control, and flood protection. The Commission shall compile flood damage figures and collect data relative to recurrence of floods. The Commission is authorized: to change the course or terminus of any artificial or natural watercourse; to shape or protect stream banks for better discharge of flood waters; to acquire dam sites; and to construct and operate dams, reservoirs, holding basins, floodgates, or other works designed to control floods. The Commission may construct dikes, levees, or other artificial barriers to protect property from inundations. The Commission may acquire land or easements over land through purchase or condemnation to carry out the purposes of this statute. The Commission, however, may not interfere with the operation of an existing levee or drainage district, and the rights of such districts to make contracts or finance their operations are not impaired. The Commission shall act on behalf of the state in dealing with other states and federal agencies in regard to flood control. The Commission's right of eminent domain is superior to those of railroads, utilities, other corporations, and local governments. (Kelly-Fla)
W69-10072

SALE OF ISLANDS.
Ark Stat Ann secs 10-601 thru 10-609 (1956), as amended, (Supp 1967).

Descriptors: *Arkansas, *Islands, *Boundaries (Property), *Ownership of beds, Legislation, Legal aspects, Navigable waters, Navigable rivers, Streams, Rivers, High water mark, Beds, Alluvium, Surveys, Land forming, Land tenure, Riparian rights.
Identifiers: *Island formation.

All islands formed or which may form in the navigable rivers or streams of the state, subsequent to the state's admission to the Union, are declared to be the property of the state. Provision is made for the sale of such islands by the state. Such sale shall not carry title to any area which separates such island from the mainland or other islands when the separating area is below the line of ordinary highwater, as ordinarily defined by the line of timber growth. In all such cases the title of the purchaser, as the title of all other riparian owners, shall extend only to the line of ordinary highwater. All prior sales of islands in navigable rivers or streams by the state are confirmed, but in such cases the title to beds or channels below the line of ordinary highwater is reserved in the state. (Keith-Fla)
W69-10073

REMOVAL OF SAND AND GRAVEL FROM NAVIGABLE WATERS; AND SALE OR LEASE OF MINERALS ON STATE LANDS.

Ark Stat Ann secs 10-1005 thru 10-1007 (1956); secs 10-1001, 10-1009 thru 10-1013 (Supp 1967).

Descriptors: *Arkansas, *Minerology, *Sands, *Gravels, Legislation, Legal aspects, Construction materials, Road construction, Navigable waters, Beds, Ownership of beds, Navigable rivers, Royalties, Permits, Navigation, Transportation, Fishing, Recreation, Surveys, Beds under water, State governments, Administrative agencies, Lake beds, Compensation.

Sand and gravel may be removed from the beds or bars of any navigable river or lake by any federal or state agency for the purpose of road construction or maintenance without payment to the state for same. Any entity other than the foregoing which removes sand or gravel for commercial gain in connection with road construction or maintenance will pay royalties to the state for same. All such entities must keep accounts of the amount of sand and gravel so removed. Sand and gravel removed for purposes other than the foregoing will not be charged for if records are kept of its removal. It is unlawful to take sand, gravel or other minerals from the beds or bars of navigable rivers and lakes without the consent of the Commissioner of Revenues. The leasing of mineral rights in state owned land is specifically provided for. The state will not acquire title to minerals in and under lands covered by navigable waters artificially created by the state or federal government unless compensation is paid therefor. The exercise of mineral rights will be subservient to the public use of navigable waters for navigation, transportation, fishing and recreation. (Keith-Fla)
W69-10074

PACKET AND NAVIGATION COMPANIES--COAL AND STONE COMPANIES.
Ark Stat Ann secs 35-701 thru 35-710 (1962).

Descriptors: *Arkansas, *Eminent domain, *Right-of-way, *Navigable waters, Legislation, Condemnation, Legal aspects, Water rights, Non-consumptive use, Water utilization, Navigable rivers, Streams, Harbors, Transportation, Boats, Ships, Navigation, Access routes, Land appraisal, On-site investigations, Real property, Railroads, Bayous.

Packet companies that run boats as common carriers have the right of eminent domain to establish landings on streams and the right to make harbours by deepening and widening creeks and bayous emptying thereinto up to three miles from their mouths. All steamboats have the right to land, load, and unload at such places. Packet, stone, and coal companies have the right of eminent domain to construct roads to the loading places. Navigation companies that transport freight or passengers may obtain the right-of-way to connect navigable bodies of water by railroad. Rights-of-way may be obtained by petition to the county court. The court appoints a jury to value the land over which the right of way runs. That amount is to be paid to the owners, and the land is vested in the petitioner. (Douberley-Fla)
W69-10075

LEVEE AND DRAINAGE DISTRICTS.
Ark Stat Ann secs 35-1101 thru 35-1113 (1962).

Descriptors: *Arkansas, *Right-of-way, *Appraisals, *Adjudication procedure, Drainage districts, Legislation, Ditches, Drainage, Excavation, Water conveyance, Condemnation, Condemnation value, Eminent domain, Easements, Evaluation, Land appriasal, On-site investigations, Federal government, Administrative agencies, Appropriation, Relative rights, Water storage, Flow, Real property, Levees.

Levee and drainage districts are authorized to take land and rights-of-way by agreement, purchase or otherwise for levees, drains, canals or ditches. Where it is necessary to condemn rights-of-way, the circuit court appoints three disinterested appraisers for one-year terms to assess damages to and the value of appropriated lands. Where property is appropriated, districts petition the circuit court to have the appraisers make an award to owners. If no exceptions are filed after notice to owners, judgment is made for condemnation; otherwise the case is docketed for trial. Districts may refuse to pay the award or judgment and relocate without liability. Provisions are made for appraisers' fees and court costs. Owners may have a cause of action if land or rights-of-way are appropriated without consent or without procuring the legal rights, although a one-year statute of limitations is imposed. Districts may also acquire flowage and storage rights by agreement with owners or by condemnation. The purpose of the act is to take advantage of federal grants while using existing districts and tax structures. (Douberley-Fla)
W69-10076

NAVIGABLE WATERCOURSES AS FENCES.
Ark Stat Ann secs 78-1344, 78-1353 (1958).

Descriptors: *Arkansas, *Boundaries (Property), *Navigable rivers, *Watercourses (Legal), Legal aspects, Legislation, Rivers, Streams, Banks, Water gaps, Navigable waters.
Identifiers: *Fences, Fencing districts.

Where the boundary of any fencing district is a navigable river, such river is deemed to be a good and lawful fence as part of the fence enclosing the remainder of the district. Where the boundary of any fencing district lies along the bank of a navigable stream and another watercourse flows into such stream across such boundary with sufficient force to render watergaps impracticable, the distance from bank to bank of such watercourse is deemed to be a good and lawful fence as part of the fence enclosing the fencing district. (Keith-Fla)
W69-10077

CROSSING OF STREAMS BY RAILROADS.

Ind Ann Stat sec 36-1701 (1949).

Descriptors: *Indiana, *Railroads, *Watercourses (Legal), *Transportation, Legislation, Highways, Streams, Maintenance, Embankments, Grading, Canals.
Identifiers: *Crossings.

Every railroad company shall have the right to construct its railroad across any stream, watercourse, road, highway, railroad or canal which intersects with its route. Such railroad corporation shall restore and maintain the stream or watercourse, road, or canal in its former state, or in a sufficient manner so as to not unnecessarily impair its usefulness or injure its operations. (Heckerling-Fla)
W69-10175

DRAINS, CULVERTS, AND BRIDGES AS PART OF THE STATE HIGHWAY.
For primary bibliographic entry see Field 04A.
W69-10179

PARK DISTRICTS ABUTTING PUBLIC WATERS.

Ill Ann Stat ch 105, secs 11-1 thru 11-5 (Smith-Hurd 1952).

Descriptors: *Illinois, *Parks, *Reclamation, *Navigable waters, Legislation, Public benefits, Beds under water, Land tenure, State governments, Access routes, Operation and maintenance, Construction, Navigation, Damages, Bodies of water, Control, Breakwaters, Ownership of beds, Compensation.

When any park district borders upon any navigable body of water, the title to the bed or submerged land being vested in the state, said district may take possession of, enclose, fill in, reclaim, and protect any portion of such submerged land bordering thereon over which navigation is not practical. Such park district shall also have the power to construct and maintain parks over such land, and title shall then vest in such district to be held for the use and benefit of the public. The district may construct break-waters for the protection of such parks. The district shall not grant or cede away any submerged lands so reclaimed. If such park construction shuts off any property not belonging to the district from access to the water, the district shall pay all damages arising therefrom. Whenever any park district is located along any navigable body of water, the corporate authorities may control and police such body of water. The district shall have no right to interfere with navigation on any navigable body ot water or to shut off the access to any public dock or landing thereon or to shut off the access of public highways to such body of water. (Heckerling-Fla)
W69-10183

EMINENT DOMAIN.
For primary bibliographic entry see Field 04A.
W69-10185

ACQUISITION OF SUBMERGED LANDS FOR PUBLIC PARK PURPOSES.
Ill Ann Stat ch 105, secs 81, 83, 84, 92, 94 (Smith-Hurd 1952).

Descriptors: *Illinois, *Parks, *Local governments, Beds, Lakes, Lake Michigan, Riparian rights, Construction, Financing, Reclamation, Shorelines, Bridges, Navigation, Tunnels.

Whenever the commissioners of Lincoln Park shall decide to make an extension over and upon submerged lands under Lake Michigan, it shall file the plan with the Secretary of State for approval. The submerged lands thus acquired, the shore lands and riparian rights appurtenant thereto shall be used to create public park facilities. The costs of acquisition, reclamation, and construction will be paid by the commissioners from general revenue or interest bearing bonds. Every board of park commissioners may extend any park or boulevard over and upon the bed of public waters or may connect any two parks under the same board by constructing a boulevard extending upon submerged land. The commissioners may also construct viaducts, bridges, and tunnels if such are essential to said extension or connection. Land may be acquired by purchase or condemnation. The new boundary lines and dividing lines will be established by the proper suit in chancery. (Darragh-Fla)
W69-10186

STATE GOVERNMENT: A FORCE IN WATER DEVELOPMENT,
Colorado Univ., Boulder.
Leonard B. Dworsky.
IN Water: Development, Utilization, Construction, 5th Western Resources Conference, Boulder, Colo, p 139-148, 1963.

Descriptors: *Water resource development, *State jurisdiction, State administrative agencies, Statutes, Municipal water, Federal-state water rights conflicts.

Two considerations of the role of state governments in water resources development are investigated: (1) a comparison of the position of the states and the federal governments and the role of the states in regard to municipal water supply; and (2) the principles to guide formulation of state water resource development programs. Approximately 200 state agencies are responsible for various aspects of water resources development and management; 54 are identified as primary water resource agencies. Their combined annual budget approaches $79 million; however, four of these states (California, Louisiana, Massachusetts and Illinois) account for almost $65 million. State support for research is virtually non-existent. The contrast with the federal government is marked in that respect since the research efforts of the federal water resource agencies represents the bulk of the nation's expenditures for this activity. In regard to the state's role in municipal water supply, they play a fundamental one. States create the local governmental entity, authorize it to construct, operate and to maintain water systems, and to tax, apply changes and issue bonds or other securities. State agencies protect public health and public investment through review and approval procedures. The article contends that, therefore, the state stands in a pivotal position and should have strong state programs as an essential middle line between the federal and municipal function. The principles that states should adopt are: (1) a statutory state-wide policy; (2) vesting of responsibility for over-all water resources planning in a single state agency; (3) formulation of a state water plan; (4) provision to construct, operate and maintain water resource development prospects and provide financial assistance; and (5) board statutory powers to resolve conflicts. (Starr-Chicago)
W69-10193

POLITICS AND LAND USE: THE INDIANA SHORELINE OF LAKE MICHIGAN,
Chicago Univ., Ill.
Harold M. Mayer.
Annals of the Association of American Geographers, Vol 54, No 4, Dec 1964. p 508-523, 3 fig, 19 ref.

Descriptors: *Land use, *Political aspects, Lake Michigan, Indiana, Industries, *Recreation demand, Harbors, Inter-agency cooperation, Conservation, Dunes, Illinois.
Identifiers: Conflicting use, Burns Ditch, Illiana harbor proposal, Regional planning.

The article discusses the conflict for use of land on the Indiana shoreline between urban-industrial interests and recreation-conservation interests. It describes the expansion of steel mills and their need for harbors, the struggle for federal harbor development in Burns Ditch, alternative sites to Burns Ditch for major port and industrial development, the Illiana interstate 'tri-cities' harbor proposal, and conservation and recreation in the dunes area. The conflict for land on Lake Michigan illustrates the difficulties resulting when a geographical entity occupies portions of several political units, and demonstrates the potential value of comprehensive metropolitan and regional planning. Four decades of delay on the proposal for an interstate harbor illustrate the difficulties of rationally developing facilities of benefit to both Illinois and Indiana. The complexity of these issues is producing a condition in which political pressures do not constitute the effective mechanism needed to achieve the optimal solution. Objective consideration of regional problems by qualified social scientists, working through local, regional, and state planning agencies, is recommended. (Gossen-Chicago)
W69-10199

STATE REGULATION OF CHANNEL ENCROACHMENTS,
Edward W. Beuchert.
Natural Resources Journal, Vol 4, No 3, p 486-521, Jan 1965. Abt 125 ref.

Descriptors: Legislation, Flood control, Non-structural alternatives, Floodways, State governments, Channel improvement.
Identifiers: *Channel encroachment, *Model Act, Floodway-encroachment lines, Department of Water Resources.

The article focuses on channel encroachment legislation, which attempts to maintain an adequate channel for flood waters by preventing any flow-constricting development in the channel. The article analyzes existing legislation and proposes a Model Act. The proposed act is meant to be part of a greater plan of water regulation and not an isolated enactment for which a new agency must be set up. The act declares that floodway-encroachment lines be established along watercourses and drainways and establishes, as a part of the Department of Water Resources, a program to delineate Department Floodways from Statutory Floodways. The Department will collect flood data, legislate encroachment lines, and alter lines as necessary. Additional sections of the Model Act cover: nuisances; unlawful acts; permits; power to remove obstruction; the Department's right of entry on lands and waters; power of making investigations; exception for certain watercourses and drainways; penalties; orders and rules of the Department; remedies; and severability. (Gossen-Chicago)
W69-10207

THE ECONOMICS OF WATER TRANSFER,
California Univ., Berkeley. Giannini Foundation.
For primary bibliographic entry see Field 06B.
W69-10208

THE COLUMBIA RIVER TREATY AND PROTOCOL AGREEMENT,
W. R. Derrick Sewell.
Natural Resources Journal, Vol 4, No 2, p 309-331, Oct 1964. 2 fig, 2 tab, 42 ref.

Descriptors: *International waters, History, International Joint Commission, Water distribution (Applied), Optimization, United States, Columbia River, Negotiations.
Identifiers: *Columbia River Treaty, *Protocol Agreement, *Unified basin development, Downstream, Benefits, Canada, British Columbia, Ottawa.

There are three broad types of international river development: unilateral, exclusive and unified. There are no examples of unified development of international rivers. The Columbia River offered possibilities of unified basin development but the Columbia River Treaty falls short of that ideal. Section I discusses origins of the Treaty, focusing on International Joint Commission investigations, debates over Canada's right to downstream benefits, and a method for determining the magnitude of downstream benefits and for allocating benefits. Section II describes the Treaty. Section III discusses British Columbia-Ottawa relations, focusing on the proposed agreement between British Columbia and the Kaiser Aluminum Company, disagreement over the sale of downstream benefits, expropriation of the British Columbia Electric Company, and the British Columbia-Canada agreement. Section IV describes the Protocol Agreement, which removed some objections raised in Canada about the original Treaty. Section V documents opposition to the Treaty, focusing on the proposed McNaughton Plan, the High Arrow Project, and flood control payments. The article concludes that, although optimum use of the River will not be achieved, the Treaty benefits both countries by facilitating development of a resource which

would have remained undeveloped. (Gossen-Chicago)
W69-10209

DETERMINING WATER REQUIREMENTS FOR SETTLING WATER DISPUTES,
For primary bibliographic entry see Field 06D.
W69-10211

ARIZONA v. CALIFORNIA -- A BRIEF REVIEW,
Rutgers - The State Univ., New Brunswick, N.J.
David Haber.
Natural Resources Journal, Vol 4, No 1, p 17-28, May 1964. 41 ref.

Descriptors: *Judicial decisions, Water allocation (Policy), Interstate rivers, Colorado River, California, Arizona, Navigable waters, Water distribution (Applied), Contracts, Legislation, Federal jurisdictions, Administrative agencies, Water resources development, Cost allocation.

The U.S. Supreme Court ruled on the struggle between California and Arizona for Colorado River water. Its decision recognized for the first time the power of Congress to control apportionment; and its language suggested that the power can be extended to non-navigable streams. Second, the opinion holds that the Secretary of the Interior has the power to allocate water within a state through contracts without regard to the state's water allocation laws and under very broad standards established by federal law. Policy accomplishments of the decision are as follows: (1) The allocation problem was transferred from the Court to the political and administrative arenas; (2) The great power given to the federal government has created the leverage to force states to make agreements; (3) These powers make it possible to accomplish a fully integrated development-allocation scheme without interference of conflicting state authority; and (4) No undue share of the cost will be placed on individual users for the benefit of the entire community or of other users. There are ambiguities in the decision; but it offers Congress the opportunity to integrate water development and use control of the entire region. (Gossen-Chicago)
W69-10212

THE INTERSTATE COMPACT--A FORM OF CREATIVE FEDERALISM,
For primary bibliographic entry see Field 06B.
W69-10214

WATER RECREATION - PUBLIC USE OF 'PRIVATE' WATERS,
For primary bibliographic entry see Field 06B.
W69-10215

WATER RIGHTS LAW IN IOWA,
For primary bibliographic entry see Field 06C.
W69-10216

TRENDS IN WATER RIGHTS LEGISLATION.
For primary bibliographic entry see Field 06B.
W69-10217

LAKE MICHIGAN RIGHTS OF RIPARIAN OWNERS.
Ind Ann Stat secs 62-701 thru 62-703 (1962).

Descriptors: *Indiana, *Lake Michigan, *Riparian rights, Reclamation, Parks, Beds, Lake beds, Landfills, Harbors, Docks, Great Lakes, Great Lakes region, Navigable waters, Recreation, Easements, Land development, Patents, Surveys, Land tenure, Land reclamation, Legal aspects, Riparian land.
Identifiers: Abutting land owners.

Land owners or the owners of any easement for public park purposes in, over, or through any land bordering on the waters of Lake Michigan have the right to reclaim submerged lands adjacent to their lands. Submerged lands between the shore and the dock or harbor line established by the United States may be reclaimed. A patent from the state shall issue to the owners of reclaimed land upon payment of a certain fee per acre. The reclaimed land may be used for commercial, manufacturing, recreational, and public purposes. (McDonough-Fla)
W69-10218

SWAMP, SALINE, AND MEANDER LANDS OF STATE-PURCHASE FOR PUBLIC PARK OR FOREST PURPOSES.

Ind Ann Stat sec 62-217 (1962).

Descriptors: *Indiana, *Public lands, *Land use, *Land development, Legislation, Parks, Recreation facilities, Forests, Saline soils, Swamps, Bogs, Salt marshes, Fresh water marshes, Meanders, Streams, Banks, Legal aspects.

State owned swamp, saline, and meander lands bordering on lakes and streams may be purchased for public park and forest purposes by natural persons, corporations, associations and municipalities or by any combination thereof. (McDonough-Fla)
W69-10219

WATER RIGHTS POLICIES IN THE SOUTHEAST,
For primary bibliographic entry see Field 06B.
W69-10220

WATER RIGHTS AND ADMINISTRATION WITH RESPECT TO SOIL AND WATER CONSERVATION,
C. E. Busby.
Agric Engin, Vol 34, No 11, p 769-770, 772, 774, 776, 778, 780, Nov 1953. 7 p, 18 ref.

Descriptors: *Water rights, *Soil conservation, *Water conservation, *Administration, Legal aspects, Regions, Adoption of practices, Water resources, Land use, Water utilization, Engineering, Damages, Flood damage, Erosion, State governments, Local governments, Surface waters, Groundwater, Watercourses (Legal).

Water problems which have legal and administrative implications arise out of an over-abundance or a shortage of water. Rapid increases in the rate of water use since World War II have been accompanied by droughts, continuing pollution of streams, and lack of sufficient storage capacity which have created acute problems, particularly in the seaboard states. The soil conservation movement has also grown during this period, and its areas of concern are interdependent upon the problems of water usage and water damage which affect land use. The farmers engaged in soil conservation projects should give consideration to the legal and administrative facets of related water problems and should cooperate with other groups in improving water laws and administrative systems. Improvements in water law and administration should include: (1) legislative control over artificial rainmaking; (2) study and legislation regarding management and use of diffused surface waters; and (3) conservation measures for streams, lake waters, and ground waters. A progressive trend in western states to create systems of water rights better adapted to problems of expanding economy and of orderly development and conservation should be followed in the East. (Kelly-Fla)
W69-10221

DEPOSIT OF SAWMILL WASTE IN WATERS.
For primary bibliographic entry see Field 05G.
W69-10222

ERECTION AND INSPECTION OF DAMS.
For primary bibliographic entry see Field 04A.
W69-10223

CONNECTICUT RIVER FLOOD CONTROL COMPACT.
For primary bibliographic entry see Field 04A.
W69-10224

DRAINAGE OF LOW LANDS.
For primary bibliographic entry see Field 04A.
W69-10225

RUBIN V W. H. HINMAN, INC. (STATE DRAINAGE EASEMENTS).
For primary bibliographic entry see Field 04A.
W69-10226

FISH.
Ill Ann Stat ch 56, secs 141-159 (Smith-Hurd 1967), as amended, (Supp 1969).

Descriptors: *Illinois, *Fish, *Administrative agencies, *Conservation, State governments, Pollution, Fish stocking, Schools, Legislation, Fish management, Fish harvest, Investigations, Fish conservation, Planning.

The 'fish code of Illinois' is to be administered by the Department of Conservation. Fishing seasons and limits established by this department are designed to preserve the biological balance. The department shall also conduct pollution investigations, plan for propagation and stocking of fish, frogs, and mussels, including the production of eggs in cooperative units for stocking. The Department shall take all steps necessary to further the cause of fish conservation including bringing actions for violations of fish regulations. Training schools shall be established to instruct in the science of conservation. Both conservation employees and regular police officers may enforce provisions of this act. Violations are tried in the circuit court. These officers may search and confiscate all fish and devices or contraband involved in these illegal activities. Each such fish, minnow, frog, mussel, or part thereof illegally taken shall constitute a separate offense, and all fines, fees, and income collected by the department shall go into the game and fish fund. (Darragh-Fla)
W69-10227

DEPARTMENT OF NATURAL RESOURCES.
Ky Rev Stat Ann secs 146.010 - 146.120 (1963), as amended, (Supp 1968).

Descriptors: *Kentucky, *Natural resources, *Water conservation, *Soil conservation, Legislation, Legal aspects, Flood control, Water utilization, Industrial water, Strip mines, Conservation, Administrative agencies, Forestry, Watershed management, Drainage, Reclamation, Water resources, Resources.

The Department of Natural Resources is responsible for: (1) the conservation of natural resources, except wildlife; (2) flood control and water usage; and (3) strip mining and reclamation. There is provision for organization and administration of the Department. Conservation and maintenance of state controlled forests are provided for. A Division of Soil and Water Conservation is created to assist existing soil and water conservation districts and watershed conservancy districts. The Soil and Water Conservation Commission is given the power to take any action it may consider necessary for the purposes of assisting soil and water conservation districts or watershed conservancy districts in carrying out their functions and discharging the state's responsibilities relating to flood control, drainage and other activities with respect to conservation, utilization or control of soil or water resources. (Keith-Fla)
W69-10228

FISH AND WILDLIFE REGULATIONS.
Ky Rev Stat Ann secs 150.110-110.180 (1963), as amended, (Supp 1968).

Descriptors: *Kentucky, *Fish conservation, *Wildlife conservation, *Permits, Legislation, Legal aspects, Mussels, Fish, Wildlife, Regulation, Streams, Administrative agencies, Bodies of water, Fishing, Sport fishing.
Identifiers: Penalties (Criminal).

Conservation officers may arrest anyone violating any of the regulations made for the protection of mussels, fish, or wildlife. Fines collected for violation of wildlife regulations are paid into the game and fish fund. Such funds may only be used to carry out the purposes of the chapter for the protection of wildlife. Licensing requirements for the taking of wildlife are specifically enumerated. Mussels and fish other than sport fish may be bought, sold, and transported when in legal possession. Otherwise the purchase, sale, and transportation of wildlife is largely prohibited. (Keith-Fla)
W69-10229

OPERATION OF WATERCRAFT.

Ind Ann Stat secs 68-813 thru 68-871 (1961), as amended, (Supp 1968).

Descriptors: *Indiana, *Boating regulations, *Boats, *Recreation, Navigation, Safety, Inspection, Bodies of water, Lakes, Lake Michigan, Great Lakes, Legal aspects, Right-of-way, Legislation, Water sports, Equipment.
Identifiers: Penalties (Civil).

The operation of watercraft on Indiana public waters for commercial and recreational purposes is regulated by various safety and operational provisions. These provisions include the designation of the types of equipment required on watercraft, who may operate watercraft, and the rules of boating safety. Violations of this chapter are a misdemeanor. (McDonough-Fla)
W69-10230

GAME AND FISH REFUGES.

Ark Stat Ann secs 47-701 thru 47-708 (1964).

Descriptors: *Administrative agencies, Wildlife management, Fish management, Wildlife conservation, Fish conservation, Land classification, Damages, Assessments, Appraisals, Local governments, State governments, Legislation.

When an owner of 640 acres of land or more desires the land to be set aside as a refuge, he may petition the State Game and Fish Commission. The owner must be willing to vest the state with title to the land. If the Commission is satisfied that the lands are suitable they may establish a refuge and post notices to this effect. The commission may acquire lands for this purpose by gift or purchase and formulate rules for preservation of wildlife. The Commission may acquire watered areas and adjacent lands to be used as fish refuges. The governor may also set aside state lands to be used as refuges and such lands may not later be reclaimed or disposed of by the state. (Darragh-Fla)
W69-10231

DOCKS.
For primary bibliographic entry see Field 04A.
W69-10232

LEVEE AND DRAINAGE DISTRICTS.
For primary bibliographic entry see Field 04A.
W69-10233

REGIONAL WATER DISTRIBUTION DISTRICT ACT.
For primary bibliographic entry see Field 04A.
W69-10234

WHITE RIVER NAVIGATION DISTRICT COMMISSION.
For primary bibliographic entry see Field 04A.
W69-10235

ARKANSAS WATERWAYS COMMISSION.
For primary bibliographic entry see Field 04A.
W69-10236

BRADSHAW V STATE HIGHWAY COMM'R (REQUIREMENT OF LANDOWNERS TO MITIGATE CONDEMNATION DAMAGES).
For primary bibliographic entry see Field 04C.
W69-10237

WINYAH BAY TO SOUTH, ASHLEY RIVER AND SHIPYARD RIVER.
For primary bibliographic entry see Field 04A.
W69-10238

DAVIS V CAHOON (DIVERSION OF NATURAL FLOW BY LOWER LANDOWNER PROHIBITED).
For primary bibliographic entry see Field 04A.
W69-10239

BLOOM V WATER RESOURCES COMMISSION (RELATIVE RIGHTS OF OWNERS OF ADJACENT UPLANDS).
For primary bibliographic entry see Field 04A.
W69-10240

SKAFF V SIOUX CITY (UNREASONABLE DELAY IN CONDEMNATION PROCEEDINGS).
For primary bibliographic entry see Field 04A.
W69-10241

REUTER V DEPT OF NATURAL RESOURCES (ADMINISTRATIVE FINDING OF EFFECTS UPON WATER POLLUTION AS PREREQUISITE TO ISSUANCE OF DREDGING PERMITS).
For primary bibliographic entry see Field 05G.
W69-10242

DISTRICTS TO MAINTAIN AND OPERATE FLOOD CONTROL WORKS.
For primary bibliographic entry see Field 04A.
W69-10243

DISTRICTS TO MAINTAIN AND OPERATE FLOOD CONTROL WORKS.
For primary bibliographic entry see Field 04A.
W69-10244

DISTRICTS TO MAINTAIN AND OPERATE FLOOD CONTROL WORKS.
For primary bibliographic entry see Field 04A.
W69-10245

WATER SUPPLY.
For primary bibliographic entry see Field 05G.
W69-10246

GREAT LAKES RIVER BASINS COMMISSION.
For primary bibliographic entry see Field 06B.
W69-10247

POWER TO ACQUIRE PIERS AND BEACHES.
For primary bibliographic entry see Field 04A.
W69-10248

RAILROAD COMPANY MAY OPERATE FERRY.
Ky Rev Stat Ann sec 277.090 (1963).

Descriptors: *Kentucky, *Railroads, *Transportation, *Boats, Legislation, Operation and maintenance, Streams, Boundaries (Surfaces), Legal aspects.
Identifiers: *Ferries.

Any railroad company may, without securing the grant of any ferry franchise or privilege from the county court, transport or employ other persons to transport for it, any passengers, baggage, or freight carried on its railroad line across any stream within or bordering upon this state. Any railroad operating a ferry for the above purposes may not operate the ferry within a mile and a half of any ferry already in operation. (Heckerling-Florida)
W69-10249

STATE AID IN FLOOD CONTROL; MUNICIPAL-FEDERAL FLOOD CONTROL PROJECTS.
For primary bibliographic entry see Field 04A.
W69-10250

LOCATING SOURCE OF WATER SUPPLY OUTSIDE OF MUNICIPALITIES.
For primary bibliographic entry see Field 04A.
W69-10251

TENNESSEE RIVER BASIN WATER POLLUTION CONTROL COMPACT.
For primary bibliographic entry see Field 05G.
W69-10296

INTERSTATE WATER SANITATION BOARD.
For primary bibliographic entry see Field 05G.
W69-10297

GROUND WATER CONSERVATION.
For primary bibliographic entry see Field 04B.
W69-10298

STREAM CAVING AND ROAD CONSTRUCTION.
For primary bibliographic entry see Field 04C.
W69-10299

SANITARY PROVISIONS.
For primary bibliographic entry see Field 05F.
W69-10300

6F. Nonstructural Alternatives

THE FLOODPLAIN AND THE SEASHORE: A COMPARATIVE ANALYSIS OF HAZARD-ZONE OCCUPANCE,
Ian Burton, and Robert W. Kates.
Geographical Review, p 366-385, July 1964. 11 fig, 31 ref.

Descriptors: Non-structural alternatives, Flood plain zoning, Coastal plains, River basins, Flood control, Flood protection, Engineering structures, Federal project policy, Hydrologic aspects, Engineering.
Identifiers: *Hazard-zone occupance, *Research needs, Geomorphic aspects.

The United States is in danger of implementing a costly program of coastal defense against storms comparable with flood control programs for rivers, which have depended exclusively on engineering works, to the neglect of possible alternatives. Despite federal expenditures of about five billion dollars average annual flood damages from rivers have continued to rise. It is feared that a program to 'contain' the sea would suffer similar results. One adjustment to storm hazards that requires at-

tention is zoning. For careful guidance in the human occupance of hazardous areas, the article recommends research on the rate and process of settlement of these areas. To establish rates of encroachment, the areas of hazard must be defined. The most satisfactory definition would be based on the factors determining the height of surge in recorded storms. To understand the processes of development, the attitudes and perceptions of coastal developers, businessmen and residents must be studies. In order to establish a body of concepts dealing with development processes and possible adjustments in areas of high hazard, the article compares floodplains and coastal areas from three perspectives: (1) hydrologic features; (2) geomorphic factors; and (3) the role of engineering. (Gossen-Chicago)
W69-10204

6G. Ecologic Impact of Water Development

GEOLOGY FOR PLANNING IN MCHENRY COUNTY,
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 06B.
W69-09912

RESERVOIR LOCATION FOR URBAN RECREATION,
Purdue Univ., West Lafayette, Ind.
For primary bibliographic entry see Field 04C.
W69-10022

EFFECTS OF SURFACE MINING ON THE FISH AND WILDLIFE RESOURCES OF THE UNITED STATES,
Bureau of Sport Fisheries and Wildlife, Washington, D.C.
For primary bibliographic entry see Field 05C.
W69-10137

A FRAMEWORK FOR DEALING WITH THE URBAN ENVIRONMENT: INTRODUCTORY STATEMENT,
Resources for the Future, Inc., Washington, D.C.
For primary bibliographic entry see Field 06B.
W69-10206

07. RESOURCES DATA

7A. Network Design

FLOW MEASURING STRUCTURES IN THE HYDROLOGICAL OBSERVATION NETWORK,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 02E.
W69-09929

SUMMARY OF HYDROLOGIC AND PHYSICAL PROPERTIES OF ROCK AND SOIL MATERIALS, AS ANALYZED BY THE HYDROLOGIC LABORATORY OF THE U.S. GEOLOGICAL SURVEY, 1948-60,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02J.
W69-10143

COMPUTERIZED SYSTEM FOR WYOMING SURFACE WATER RECORDS,
Wyoming State Engineer's Office, Cheyenne.
William N. Embree, and Lee W. Larson.
State Water Plan Report No 1, Water Resources Series No 13, Sept 1968. 66 p, 2 fig, 3 append.

Descriptors: Annual discharge, Automation, *Computer programs, *Data processing, *Data storage and retrieval, Duration curves, Frequency analysis, Hydrologic data, Information retrieval, Maximum flow, Mean daily flow, Minimum flow, *Streamflow, *Surface waters, Water resources, Water year.

A general description of a computerized system for Wyoming Surface Water Records is given. This system, developed by the University of Wyoming's Water Resources Research Institute, in conjunction with the Computer Center, is designed to store and utilize streamflow data. All available programs and types of output are described and procedures for operation of the system are given.
W69-10213

7B. Data Acquisition

UNSTEADY CIRCULATION IN SHALLOW LAKES,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 02H.
W69-09886

PROCESSING OF DIGITAL DATA LOGGER STD TAPES AT THE SCRIPPS INSTITUTION OF OCEANOGRAPHY AND THE BUREAU OF COMMERCIAL FISHERIES, LA JOLLA, CALIFORNIA,
Bureau of Commercial Fisheries, La Jolla, Calif. Fish-Oceanographic Center.
For primary bibliographic entry see Field 07C.
W69-09894

RECORDED OBSERVATIONS ON THE INFLUENCE OF CLOUDINESS AND WIND VELOCITY ON THE BRIGHTNESS OF THE DAYLIGHT SKY ABOVE THE WATER SPACE (RUSSIAN),
For primary bibliographic entry see Field 02B.
W69-09899

MEASUREMENT OF WATER PROFILES USING A GAMMA-RAY METHOD (FRENCH),
Department of Agronomical Sciences of the State, Gembloux (Belgium).
A. Bentz.
La Trib du Cebedeau, Vol 22, No 305, p 186-190, Apr 1969. 5 p, 6 fig, 1 tab, 5 ref.

Descriptors: *Nuclear moisture meters, *Water properties, *Gamma rays, *Hydraulic properties, *Hydraulic gradient, Hydraulic engineering, Radioisotopes, Soil density, Neutron activation analysis, Diffusion, Absorption, Mathematical studies, Drainage, Instrumentation, Temperature, Geology, Sands.
Identifiers: *Gamma-ray soil moisture meters.

The principles, applications, and results of the application of a gamma-ray method for the study of hydraulic profiles of very thin water-bearing beds are described. The discussion includes (1) analytical principle of the method; (2) apparatus; (3) the utilization of the apparatus (determination of absorption coefficients, the use of soil columns); and (4) examples of the method application. The gamma-ray method is a reliable tool for the evaluation of hydraulic profiles of thin soils. (Gabriel-USGS)
W69-09904

DISCHARGE MEASUREMENT IN OPEN CHANNELS BY DILUTION METHODS (FRENCH),
Liege Univ. (Belgium).
Alb Schlag.
La Trib du Cebedeau, Vol 22, No 305, p 196-198, Apr 1969. 3 p, 7 fig.

Descriptors: *Discharge (Water), *Discharge measurement, *Tracers, Solutes, Hydraulic properties, Open channel flow, Water supply, Solvents, Salinity, Injection, Mathematical studies.
Identifiers: Discharge measurement by dilution.

The use of dilution methods to measure wate discharges in open canals is described. For tha purpose a definite volume of concentrated solutio is injected upstream and a water sample take downstream is analyzed for the salt content. The concentrations can be measured by volumetri chemical analysis, by colormetric analysis and b electrical conductivity. The application of the dilu tion method to measure discharges in open con duits was found to be of value. (Gabriel-USGS)
W69-09905

MICROWAVE RADIOMETRIC SENSING O SOIL MOISTURE CONTENT,
Aerojet-General Corp., El Monte, Calif. Space Div
J. M. Kennedy, and A. T. Edgerton.
Symp on Geochem, Precipitation, Evaporation Soil-Moisture, Hydrom, Proc Gen Assembly o Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Publ N 78, p 418-429, 1968. 12 p, 11 fig, 1 tab.

Descriptors: *Soil moisture meters, *Microwaves *Remote sensing, Aircraft, Electromagnetic waves Instrumentation, Measurement, Radar.
Identifiers: Microwave soil moisture meters.

A field measurements program was conducted t determine the response of microwave radiometer to soil moisture content. Materials investigated in clude beach sand, unconsolidated tideland mud playa sediments, and loam. Dual polarization mea surement were made at frequencies of 13.5 GH and 37 GHz with aspect angles from nadir t horizontal. The intensity of thermal radiation de pends on the temperature and emissivity of the ob ject and on the frequency of observation. Soil tota emitted energy can be separated into the emitte energy and the reflected energy. Emitted energy i the product of soil temperature and soil emissivity Reflected energy is the product of microwave sk temperature and material reflectivity. The dielec tric properties of soils are strongly dependent o soil moisture content. Changes in the dielectri constant result in major changes in the emissivit and radiometric brightness temperature Microwave temperature differences between satu rated tidal mud and ocean water covering the mu were found to be about 20 deg K. Soils and sedi ments containing 1 to 7% water were found to b 120 deg K warmer than the saturated muds. Th radiometric temperature difference between play sediments containing 12 and 30% moisture conten was found to be 60 deg K. Polarization effects als changed drastically depending on the viewing angl at which measurements were made. These mea surements demonstrate that microwave radiomet ric surveys can aid hydrologists in many investiga tions, particularly for airborne applications o hydrological studies of large tracts of land. (Knapp USGS)
W69-09916

DETERMINATION OF THE SEASONAL AN MONTHLY EVAPORATION NORMALS FRO AGRICULTURAL FIELDS FROM OBSERVA TIONS AT A NETWORK OF STATIONS,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02D.
W69-09921

INFRARED EXPLORATION FOR COASTA AND SHORELINE SPRINGS,
Stanford Univ., Calif. Dept. of Mineral Engineer ing; and Stanford Univ., Calif. Dept. of Geology.
R. J. P. Lyon, and Keenan Lee.
Stanford Univ RSL Tech Rep No 68-1, Oct 1 1968. 68 p, 25 fig, 1 tab, 83 ref, 2 append. 14-08 0001-11217 (USGS).

Descriptors: *Remote sensing, *Infrared radiation *Springs, *Lakes, *California, *Nevada, Therma springs, Cold springs, Saline water, Arid lands Mixing, Water quality, Discharge (Water) Hydrogeology, Water levels, Groundwater.
Identifiers: *Mono Lake (Calif).

An infrared scanning system is being developed to detect, delineate and evaluate discharge of coastal and shoreline springs. A field testing program involves establishing the hydrogeologic parameters of a test site at Mono Lake, California-Nevada and collecting infrared scanner data. Mono Lake is a rapidly desiccating saline lake in a closed desert basin. The salinity of Mono Lake has increased 50% in the past 20 yr to 76,000 ppm dissolved solids. It is suggested that the lake concentrates natural runoff and groundwaters, modified by addition of thermal spring waters high in Cl and sulfate. Other springs have Ca-bicarbonate waters of low temperature and low total dissolved solids. Two missions were flown at Mono Lake, in October 1967 and June 1968, using the Bendix Thermal Mapper, a line scanner operating in the 0.7 to 5.5 micron region of the infrared. An infrared radiometer (8-14 microns) was used for absolute temperature measurements and was correlated with pertinent ground control measurements. Some multiband photography was taken. Shoreline springs as small as 2 gpm were detected, and all known springs with more than a few gpm discharge can be recognized. Many previously unknown springs were discovered. Unexpected findings on imagery include an apparent surface expression of shallow sublake topography and a secondary plume of colder surface water offshore from warm springs. Spring discharge patterns were delineated by reducing imagery to isothermal maps. (Knapp-USGS)
W69-09932

HEATED THERMOPILE ANEMOMETER COMPARED WITH SENSITIVE CUP ANEMOMETER IN NATURAL AIRFLOW,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Experiment Station.
James D. Bergen.
Rocky Mountain Forest and Range Experiment Station, USDA Forest Service Research Note RM-147, 1969. 4 p, 2 figs, 1 table, 1 ref.

Descriptors: *Instrumentation, *Anemometers, Winds, Velocity, Wind velocity, Meteorology, Air circulation, Equipment.
Identifiers: Errors.

Comparison of twenty 5-minute average speeds showed discrepancies of as much as plus or minus 50 percent with windspeeds ranging from 2.8 to 6.6 miles per hour. The magnitude and sense of the deviations did not vary systematically with turbulence intensity or speed. Measurements were made at an air temperature of about 20 deg C.
W69-09985

EFFECTS OF NEUTRON SOURCE TYPE ON SOIL MOISTURE MEASUREMENT,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Irving Goldberg, Norman A. MacGillivray, and Robert R. Ziemer.
Trans Amer Nuclear Soc 10 (1):20-21, 1967.

Descriptors: *Soil moisture, *Soil moisture meters, Soils, Instrumentation, Soil moisture, California, *Nuclear moisture meters, *Meteorology, Nuclear meters.
Identifiers: *Hydrometeorology, Americium-beryllium, Soil moisture measurement.

The effects on soil moisture determination of four different alpha-neutron sources (RaBe, AcBe, PuBe, and AmBe) used in neutron meters were evaluated. (Ziemer-Forest Service)
W69-09986

MEASURING MOISTURE NEAR SOIL SURFACE. , .MINOR DIFFERENCES DUE TO NEUTRON SOURCE TYPE,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Robert R. Ziemer, Norman A. MacGillivray, and Irving Goldberg.
US Forest Serv Res Note PSW-158, Pacific SW. Forest and Range Exp Sta, Berkeley, Calif, 1967. 6 p, illus.

Descriptors: *Soil moisture, *Nuclear moisture meters, *Soil moisture meters, Soils, Instrumentation, *Meteorology, Nuclear meters, Soil moisture, California.
Identifiers: *Hydrometeorology, Americium-beryllium, Soil moisture measurement.

The variability in surface detection by the four different neutron sources tested may be due to differences in neutron energy or in length of source or in both. (Ziemer-Forest Service)
W69-09987

MECHANICS AND RATES OF NATURAL SOIL CREEP,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Eugene Kojan.
Proc Fifth Annual Eng Geol and Soils Eng Symp, Pocatello, Idaho, April 1967. p 233-253.

Descriptors: Creep, *Slope stability, *Shear strength, *Landslides, *Soil strength, Soils, Soil stability, Shear, Soil mechanics, California, Erosion, Soil tests.
Identifiers: Over-consolidated sediments.

Ordinary concepts of effective peak shear strength are not applicable in estimating slope stability where creep is prevalent, especially in soils developing on the rapidly eroding, highly over-consolidated sediments of the Coast Ranges.
W69-09988

LEACHABILITY OF A WETTING-AGENT TREATMENT FOR WATER-RESISTANT SOILS,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 02G.
W69-09989

INSTRUMENTATION FOR SNOW GAGING -- YESTERDAY, TODAY, AND TOMORROW,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
James L. Smith.
Isotope and Radiat Tech 4 (3):227-237, 1967. 10 p.

Descriptors: *Gamma rays, Watershed management, Snowmelt, Snowpacks, *Precipitation gages, Instrumentation, Snow, Rainfall, California.
Identifiers: *Nuclear snow gage, *Snow measurement, Snow density measurement.

Three systems of snow gaging have been used. These consist of gravimetric methods, weighing platforms, and nuclear gages. The development of these systems is described, along with their advantages and disadvantages. (Smith-Forest Service)
W69-09992

SNOW EVAPORATION REDUCTION: MIGRATION OF EVAPORATION SUPPRESSANTS THROUGH SNOW,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Edward H. Essington, and James L. Smith.
Trans American Nuclear Society, 1967. Vol 10, No 1, p 77.

Descriptors: *Snowmelt, *Evaporation control, *Evaporation, Snowpacks, Snow, Tracers, California, Hexadecanol, Monomolecular films.
Identifiers: Snow evaporation suppression.

Movement of evaporation suppressants on and through snowpacks is being studied with use of isotopes. Laboratory studies show tracer to be reliable. Future research will follow disposition of the tracer applied to snowpacks as snowpacks melt. (Smith-Forest Service)
W69-09993

GAMMA-TRANSMISSION PROFILING RADIOSOTOPE SNOW DENSITY AND DEPTH GAGE,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
James L. Smith, and Donald W. Willen.
West Snow Conf Proc, 1966. p 69-77.

Descriptors: *Precipitation gages, *Snow, Snowpacks, *Gamma rays, Watershed management, Snowmelt, California.
Identifiers: *Gamma-transmission system, Rain-on-snow, *Nuclear snow gage.

A gamma-transmission system can measure snow density adequately throughout a snowpack profile. It can be used to determine density increases due to snowmelt or rain on snow, and there is no effect on attenuation by the different forms of water. (Smith-Forest Service)
W69-09994

ISOTOPE SNOW GAGES FOR DETERMINING HYDROLOGIC CHARACTERISTICS OF SNOWPACKS,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
James L. Smith, and Donald W. Willen.
IN Isotope Techniques in the Hydrologic Cycle, Amer Geophys Union Geophys Mono 11, 1967. p 11-21, illus.

Descriptors: Hydrology, Watershed management, Snowmelt, *Precipitation gages, Snowpacks, California.
Identifiers: *Snow density.

The isotope snow gage has proved to be superior to any system heretofore used for detection of snow depth, water content, and density. (Smith-Forest Service)
W69-09995

ISOTOPES -- A MULTIPURPOSE TOOL FOR FOREST WATERSHED RESEARCH,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
James L. Smith.
Int Symp on Forest Hydrol, Pa State University, Aug 29-Sept 10, 1965, New York, Pergamon Press, 1967. p 771-778

Descriptors: Hydrology, Watershed management, Snowmelt, *Precipitation gages, Instrumentation, Tracers.
Identifiers: Snow density.

A snow gage of new design has been tested which measures snow density in situ in half-inch increments throughout a snowpack. (Smith-Forest Service)
W69-09996

PORTABLE RADIOACTIVE ISOTOPE SNOW GAGES FOR PROFILING SNOWPACKS,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
James L. Smith, Donald W. Willen, and Michael S. Owens.
US Atomic Energy Comm, Div Tech Info, TID-23368, 1966. 51 p, illus.

Descriptors: Hydrology, Watershed management, Snowmelt, *Snowpacks, *Precipitation gages, California.
Identifiers: Snow measurement.

Describes portable, battery-operated neutron and gamma scatter gages; gamma transmission gages have been tested for their ability to profile snowpacks. (Smith-Forest Service)

W69-09997

A GAMMA-TRANSMISSION GAGE FOR PROFILING SNOWPACK,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
James L. Smith, Donald W. Willen, and Michael Owens.
US Atomic Energy Comm, Isotope Syst Develop Conf Proc, Washington, D.C. 1965. p 36-37.

Descriptors: Hydrology, Watershed management, Snowmelt, Snowpacks, Precipitation gages, Instrumentation, California, Gamma rays.
Identifiers: Snow measurement, Density profiles.

A gamma-transmission gage for profiling snowpacks has been successfully tested. It is possible to profile a snowpack in one-half inch vertical increments. Snow density measurements are accurate to within 1/2 percent of actual density. (Smith-Forest Ser)
W69-10000

MEASUREMENT OF SNOWPACK PROFILES WITH RADIOACTIVE ISOTOPES,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
James L. Smith, Donald W. Willen, and Michael S. Owens.
Weatherwise 18 (6), p 246-251, 257, 287, Dec 1965.

Descriptors: Hydrology, Watershed management, Snowmelt, Snowpacks, Instrumentation, California, Gamma rays.
Identifiers: *Snow measurements, Snow density.

A snow gage using cessium-137 as the source and sodium-iodine crystal for detector measured snow density accurately in 1/2-inch vertical increments. With this system a 10-foot snowpack may be profiles in 10 minutes by moving the detector and source through the snowpack at a constant rate. Output was recorded on an analog chart. (Smith-Forest Ser)
W69-10001

IDENTIFICATION OF SPECTRAL CHARACTERISTICS OF HYDROLOGICAL SERIES BY A MODIFICATION OF THE GRENANDER-ROSSENBLATT METHOD (RUSSIAN),
For primary bibliographic entry see Field 02E.
W69-10096

INVESTIGATION OF WATER RESERVOIR BOTTOM DENSITY USING RADIOMETRIC METHODS (POLISH),
For primary bibliographic entry see Field 02J.
W69-10109

DISCHARGE MEASUREMENTS AT GAGING STATIONS,
Geological Survey, Washington, D.C.
Thomas J. Buchanan, and William P. Somers.
Geol Surv Tech Water-Resources Invest, Book 3, Chapter A8, 1969. 65 p, 73 fig, 8 tab, 15 ref.

Descriptors: *Discharge measurement, *Current meters, *Stream gages, Flowmeters, Discharge (Water), Streamflow, Open channel flow, Flumes, Weirs, Instrumentation, Gaging stations, Equipment, Floats, Hoisting machinery, Operation and maintenance.
Identifiers: *U.S. Geological Survey, Stream gaging handbook.

The techniques used in making discharge measurements at gaging stations are described. Most of the report deals with the current-meter method of measuring discharge, because this is the principal method used in gaging streams. The uses of portable weirs and flumes, floats, and volumetric tanks in measuring discharge are briefly described. The types of current meters, sounding equipment, stream-width measuring equipment, support equipment, weirs, flumes, floats, gages, and tracer methods used by the U.S. Geological Survey, are described in detail and shown by photographs. (Knapp-USGS)
W69-10111

DETERMINATION OF WATER SURFACE TEMPERATURE FROM RADIO EMISSION IN THE CENTIMETER RANGE,
State Hydrological Inst., Leningrad (USSR).
Yu. I. Rabinovich, G. G. Shchukin, and V. V. Melent'yev.
Transl from Trudy GGO, No 222, 1968, p 49-53. Soviet Hydrol Selec Pap, No 3, p 266-269, 1968. 4 p, 3 fig, 5 ref.

Descriptors: *Remote sensing, *Water temperature, *Microwaves, Electromagnetic waves, Instrumentation, Measurement, Photometry, Radiation, Thermal radiation, Cloud cover.
Identifiers: *Radiometry, Microwave radiometry.

Determination from aircraft of the temperature of the underlying surface from its emission is an important geophysical problem. Investigations of this kind had been conducted for several years in the infrared region of the spectrum in which measurements are strongly distorted by the atmosphere. Measurements in the infrared region are absolutely impossible in the presence of clouds. Use of the microwave region of the spectrum permits information to be obtained on the temperature of the underlying surface through clouds and precipitation, whose influence decrease with increasing wavelength. Large instrumental errors of the microwave measuring equipment can now be substantially reduced by improving the equipment and the method of calibrating it. (Knapp-USGS)
W69-10140

INVESTIGATION OF A METHOD OF MEASURING SNOW STORAGE BY USING THE GAMMA RADIATION OF THE EARTH,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02C.
W69-10142

A METHOD FOR THE DETERMINATION OF ZERO THICKNESS ACTIVITY OF CARBON-14 LABELED BENTHIC DIATOMS IN SAND,
Marine Lab., Aberdeen (Scotland); and Michigan State Univ., Hickory Corners. W. K. Kellogg Biological Station.
For primary bibliographic entry see Field 02L.
W69-10150

THE MEASUREMENT OF CHLOROPHYLL, PRIMARY PRODUCTIVITY, PHOTOPHOSPHORYLATION, AND MACROMOLECULES IN BENTHIC ALGAL MATS,
Indiana Univ., Bloomington. Dept. of Microbiology.
For primary bibliographic entry see Field 05C.
W69-10151

THE APPLICATION OF MICRO-AUTORADIOGRAPHIC TECHNIQUES TO ECOLOGICAL STUDIES,
Indiana Univ., Bloomington. Dept. of Microbiology.
M. Louise Brock, and Thomas D. Brock.
International Association of Theoretical and Applied Limnology, Communications, No 15, p 1-29, 1968. 6 fig, 2 tab, 38 ref.

Descriptors: *Ecology, *Radioactivity techniques, *Radioisotopes, Limnology, Oceanography, Tracers, Bacteria, Growth rates, Tritium, Photography, Carbon radioisotopes, Phosphorus radioisotopes, Algae, Emulsions, Background radiation, Iodine radioisotopes, Nutrient requirements.
Identifiers: *Micro-autoradiography, Physiology, Biochemical extraction, Millipore filters, Phase microscopy, Staining, Stripping film, Synechococcus, Grain count (Autoradiography), Leucothrix mucor, Antithamnion sarniense, Quantitation, Growth modes.

Authors describe autoradiography in detail, not only as an adjunct to other radioactivity experiments, but as a principal technique in limnology, oceanography, and related environmentally oriented disciplines. Technique can be used as a sole method to study nutrition and physiology in the laboratory as well as in the natural environment. Simple biochemical extraction methods are described. Autoradiographic results obtained from experiments based on such methods illustrate the analysis of autoradiograms and demonstrate the validity of autoradiographic techniques. Detailed information delineates the use of autoradiography in evaluating mode and rate of bacteria growth. Detailed methods for preparation of specimens, handling of liquid autoradiographic emulsion, and development of autoradiograms are given with special emphasis on limnological applications. Comparisons are made with conventional methods for assay of radioactive isotopes. Tritium was the most suitable radioactive isotope for their experiments. Liquid emulsion (NTB-2) and stripping film are compared. Qualitative evaluation can be accomplished with two-exposure photographs by focusing on grains to photograph them at half the total required exposure, then refocusing on cells to photograph them during other half of total required exposure. Relative quantitation and absolute quantitation are discussed. (Jones-Wisc)
W69-10163

7C. Evaluation, Processing and Publication

PROCESSING OF DIGITAL DATA LOGGER STD TAPES AT THE SCRIPPS INSTITUTION OF OCEANOGRAPHY AND THE BUREAU OF COMMERCIAL FISHERIES, LA JOLLA, CALIFORNIA,
Bureau of Commercial Fisheries, La Jolla, Calif. Fish-Oceanographic Center.
James H. Jones.
Fish and Wildlife Serv Spec Sci Rep-Fish No 588, June 1969. 25 p, 6 fig, 1 append.

Descriptors: *Data processing, *Hydrologic data, *Water quality, *Computer programs, Digital computers, Water temperature, Salinity, Depth, Remote sensing, Oceans, Sampling.
Identifiers: Salinity-temperature-depth data processing.

The development of continuous sampling STD (salinity-temperature-depth) sensors as a prime data collection tool for oceanographic cruises has necessitated the development of techniques capable of handling the data with modern digital computing equipment. One such technique that was developed for processing STD data collected as part of the EASTROPAC Survey Program is described. The description assumes that the data has been digitized and recorded on IBM compatible tape in the field. The computer programs needed for processing the basic data tapes are described, and a listing of the program with subroutines is given in an Appendix. (Knapp-USGS)
W69-09894

MATHEMATICAL MODELS FOR OPTIMIZING THE ALLOCATION OF STORED WATER,
Nevada Univ., Reno. Desert Research Inst.
For primary bibliographic entry see Field 06A.
W69-09918

NUMERICAL SIMULATION OF WAVE-CREST MOVEMENT IN RIVERS AND ESTUARIES,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W69-09919

COMPUTER TECHNOLOGY IN EVAPORATION STUDIES,
New Mexico State Univ., University Park. Dept. of Civil Engineering; and New Mexico State Univ., University Park. Engineering Experiment Station.
For primary bibliographic entry see Field 02D.
W69-09930

COMPARISON BETWEEN ANALOG AND DIGITAL SIMULATION TECHNIQUES FOR AQUIFER EVALUATION,
Illinois State Water Survey, Urbana.
T. A. Prickett, and C. G. Lonnquist.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 625-634, 1968. 10 p, 4 fig, 14 ref.

Descriptors: *Computer models, *Analog computers, *Digital computers, *Groundwater, Aquifers, Simulation analysis, Model studies, Numerical analysis, Mathematical models, Synthetic hydrology, Groundwater movement, Streamflow, Operations research, Analog models, Computer programs.
Identifiers: Computer model comparisons, Aquifer evaluation.

Several comparisons are made between electric analog and digital computer techniques in the evaluation of aquifer systems. The analog method described involves electronic analyzers coupled to an array of electrical resistors and capacitors simulating a scaled-down version of the aquifer. The digital solutions described are obtained by implicit numerical integration. Comparisons are first made by noting the similarities between 2 computational methods. The most important similarities include basic data requirements, method of discretizing the space variables, assigning hydrogeologic properties to the discrete portions of the model, verification of the model, and analysis of the basic problem. It was found that the main difference between the analog and digital computational techniques fall basically into 4 categories: (1) The digital method does not require as much time for model construction and data readout and is more convenient than the equipment manipulation phases needed in the analog technique; (2) the digital computer offers more versatility than the analog for solving nonlinear boundary problems; (3) the analog technique offers the advantage of an in-house simulator for a large class of groundwater problems and when it is desired to solve problems requiring an insight into the behavior of the physical system; and (4) the analog technique offers advantages when solving large problems. Factors related to accessibility of equipment and costs dictate to a large extent the simulation technique choice. (Knapp-USGS)
W69-09931

HYDROLOGIC DISTRIBUTIONS RESULTING FROM MIXED POPULATIONS AND THEIR COMPUTER SIMULATION,
Illinois State Water Survey, Urbana.
Krishan P. Singh.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 671-681. 11 p, 4 fig, 2 tab, 9 ref.

Descriptors: *Model studies, *Computer models, *Synthetic hydrology, Simulation analysis, Data processing, Statistical methods, Regression analysis, Parametric hydrology, Hydrographs, Computer programs, Probability.
Identifiers: Hydrologic simulation.

Distributions of many hydrologic variables do not conform to any one standard distribution. For example, the monthly streamflow involves a chain of causes and effects, with infinite temporal and spatial variations. The population and distribution of monthly streamflows therefore are considered as a mixed population and distribution. In order to keep the problem simple and solvable on the computer, a 2-population model is postulated for a mixed population for each of the 12 monthly streamflows. The salient features of the computer program developed for obtaining the 2-component distributions are described. The results of analyses of some streamflow records in Illinois show that observed monthly streamflow distributions can be simulated satisfactorily by the 2-component distributions obtained from the computer analysis of the parent distribution. The parameters of the component distributions exhibit distinct annual cycles as may be expected from physical reasoning. (Knapp-USGS)
W69-09935

IMPORTANCE OF MATHEMATICAL METHOD AND COMPUTING TECHNIQUE APPLICATION TO WATER RESOURCE PLANNING AND CONTROL,
All-Union Scientific Research Inst. of Hydrotechnics and Reclamation (USSR).
For primary bibliographic entry see Field 06A.
W69-09936

USE OF THE FINITE ELEMENT METHOD IN SOLVING TRANSIENT FLOW PROBLEMS IN AQUIFER SYSTEMS,
California Univ., Berkeley.
P. A. Witherspoon, I. Javandel, and S. P. Neuman.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 687-698, 1968. 12 p, 6 fig, 19 ref.

Descriptors: *Unsteady flow, *Groundwater movement, *Mathematical models, *Digital computers, Numerical analysis, Aquifers, Flow, Porous media, Synthetic hydrology, Permeability, Anisotropy.
Identifiers: Finite element method, Transient flow problems.

The finite element method is a new numerical approach for solving transient flow problems that is particularly well adapted to digital computers. In this method the partial differential equation together with the appropriate initial and boundary conditions are replaced by a corresponding variational problem. The continuum is replaced by a finite number of subregions, and the variational principle is expressed as a summation of functionals over the entire network. The resulting functional is minimized by direct methods of the calculus of variations to yield the solution to the original boundary value problem. To demonstrate the validity of this new technique, results obtained by the finite element method are compared to analytical solutions from the literature. To demonstrate the power of this approach, solutions for the more complex problem of transient flow in layered systems with crossflow are also presented. An example of results for a 2-layer aquifer is discussed. A second example of results for a 3-layer system consisting of 2 aquifers enclosing an aquitard is also discussed. The finite element method is completely general with respect to geometry, boundary conditions and rock properties and provides a powerful new method of solving fluid flow problems in complex systems. (Knapp-USGS)
W69-09937

INSTANTANEOUS UNIT HYDROGRAPH RESPONSE BY HARMONIC ANALYSIS,
Virginia Polytechnic Inst., Blacksburg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
W69-10098

WATER RESOURCES RESEARCH CATALOG, VOLUME FOUR.
Smithsonian Institution, Washington, D.C. Science Information Exchange.
For primary bibliographic entry see Field 10.
W69-10115

SIMULATION OF OXYGEN UTILIZATION IN STORAGE-TREATMENT PLANT SYSTEM,
Pennsylvania Dept. of Forests and Waters, Harrisburg; and Pittsburgh Univ., Pa.
For primary bibliographic entry see Field 05D.
W69-10128

USE OF A MATHEMATICAL MODEL IN THE HYDROLOGIC STUDY AS APPLIED TO THE VEGA DE GRENADE OF SPAIN (FRENCH),
For primary bibliographic entry see Field 02F.
W69-10147

A TABLE FOR CONVERTING pH TO HYDROGEN ION CONCENTRATION (H+) OVER THE RANGE 5-9,
Civil Aeromedical Inst., Oklahoma City, Okla.
For primary bibliographic entry see Field 02K.
W69-10148

08. ENGINEERING WORKS

8A. Structures

SUMMARY OF HYDRAULIC ENGINEERING RESEARCH SINCE 1958,
Research Inst. for Water Resources Development, Budapest (Hungary). Dept. for Hydraulic Engineering Research.
K. Stelczer.
Dep Hydraul Eng Res Rep, Res Inst Water Resources Develop, 1967. 109 p, 102 fig, 272 ref.

Descriptors: *Hydraulic structures, *Hydraulic machinery, *Testing, *Instrumentation, Watersheds (Basins), Dams, Erosion, Lakes, Streamflow, Irrigation systems, Plastics, Soil moisture meters, Soil density, Soil properties.
Identifiers: *Hungary, Hydraulic research.

A monograph containing 40 articles, this is a review and presentation of the overall picture of hydraulic construction research in Hungary from 1958 to 1967. The monograph gives titles of 272 publications by members of the scientific staff of the Hungarian Research Institute for Water Development (1958 to 1966). Besides giving a list of research papers, the publication will facilitate those engaged in similar work abroad in contacting personnel at the Institute regarding common problems. (Gabriel-USGS)
W69-09939

DETERMINATION OF DYNAMIC PRESSURE OF WATER ON A DAM USING THE EHDA METHOD AND TAKING INTO CONSIDERATION THE DAM ELASTICITY (RUSSIAN),
For primary bibliographic entry see Field 08B.
W69-10099

SEMPOR PROJECT-GENERAL PLAN,
Ministry of Public Works and Power, Djakarta (Indonesia). Water Resources Development.
Rachmat Tirtotjondro.
Indones Min Public Works and Power, Water Resources Develop Rep, Mar 1969. 27 p, 5 tab, 36 ref, 39 append.

Descriptors: *Water structure, *Water supply, *Water storage, *Reclamation, *Irrigation engineering, River basins, Cultivated lands, Foods, Population, Rainfall, Mapping, Dry seasons, Discharge measurement, Water yield, Geology, Water resources, Gaging stations.
Identifiers: Central Java, Sempor reservoir, *Indonesia.

This monograph discusses an over-all plan for construction of the Sempor reservoirs and several main canals in Central Java and for the improvement and extension of the existing distribution systems. Under this plan, 13,900 hectares of rice fields in the Karanganjar plain will receive an irrigation

water supply to secure two rice crops and one non-rice crop a year. In addition the floods, which result from poor natural drainage, will be controlled to some extent. The net capacity of the reservoir is designed to be 60 million cu m with a normal elevation level of+76 m. The estimated total project cost is $20,090,000. (Gabriel-USGS)
W69-10100

8B. Hydraulics

LONGITUDINAL DISPERSION IN OPEN CHANNELS,
Pittsburgh Univ., Pa.
For primary bibliographic entry see Field 02E.
W69-09888

RESISTANCE TO REVERSING FLOWS OVER MOVABLE BEDS,
Technical Univ. of Istanbul (Turkey).
For primary bibliographic entry see Field 02E.
W69-09892

FRICTION-FACTORS FOR FLAT-BED FLOWS IN SAND CHANNELS,
Iowa Univ., Iowa City.
For primary bibliographic entry see Field 02E.
W69-09893

SUMMARY OF HYDRAULIC ENGINEERING RESEARCH SINCE 1958,
Research Inst. for Water Resources Development, Budapest (Hungary). Dept. for Hydraulic Engineering Research.
For primary bibliographic entry see Field 08A.
W69-09939

DETERMINATION OF DYNAMIC PRESSURE OF WATER ON A DAM USING THE EHDA METHOD AND TAKING INTO CONSIDERATION THE DAM ELASTICITY (RUSSIAN),
G. P. Mamradze, and T. I. Metrebeli.
English summary provided with Russian text. Soobsch Akad Nauk, Gruz, SSR (Bull Acad Sci of Georgian SSR), Vol 53, No 3, p 657-660, Mar 1969. 4 p, 4 ref.

Descriptors: *Dam construction, *Dynamics, *Pressure, *Mathematical studies, Dams, Bottom sediments, Laplaces equation, Mechanical properties, Energy dissipation, Elastic deformation, Earthquake engineering, Soil dynamics, Vibrations, Resonance, Reservoirs.
Identifiers: Earthquake stresses (Dams).

Dynamic pressure of water on dams due to earthquakes was analytically investigated. By assuming a concept of spectral seismic stability, the final solutions expressed in terms of the proper vibrations of a dam and the soil, damping coefficient and other parameters are developed. (Gabriel-USGS)
W69-10099

METHOD OF DETERMINING THE DISCHARGE OF TWO-LEVEL SPILLWAYS,
Sredneaziatskii Nauchno-Issledovatelskii Institut Irrigatsii, Tashkent (USSR).
B. G. Polyakova.
Transl from Izvestiya Akad Nauk Uzbekskoy SSR, Ser Tekhn. Nauk, No 1, 1968, p 53-57. Soviet Hydrol Selec Pap No 3, p 296-299, 1968. 4 p, 1 fig, 9 ref.

Descriptors: *Discharge (Water), *Spillways, *Hydraulics, Outlet works, Overflow, Discharge measurement, Discharge coefficients.
Identifiers: *2-level spillways.

Methods are given for calculating flow of 2-level spillways having a horizontal gate or bridge and a lower horizontal overflow sill. No analytical method exists for such calculations, so a semi-empirical method was developed to use experimentally obtained flow resistance coefficients and structural dimensions. Nomograms are plotted to show the relationships developed and to use them to compute discharge. (Knapp-USGS)
W69-10129

8C. Hydraulic Machinery

SUMMARY OF HYDRAULIC ENGINEERING RESEARCH SINCE 1958,
Research Inst. for Water Resources Development, Budapest (Hungary). Dept. for Hydraulic Engineering Research.
For primary bibliographic entry see Field 08A.
W69-09939

ON THE EFFICIENT USE OF HIGH ASWAN DAM FOR HYDROPOWER AND IRRIGATION,
Harvard Univ., Cambridge, Mass.
For primary bibliographic entry see Field 06A.
W69-09972

8E. Rock Mechanics and Geology

GEOLOGY OF PROPOSED POWERSITES AT DEER LAKE AND KASNYKU LAKE, BARANOF ISLAND, SOUTHEASTERN ALASKA,
Geological Survey, Washington, D.C.
Alexander A. Wanek, and James E. Callahan.
Geol Surv Bull 1211-C, 1969. 25 p, 1 fig, 1 plate, 1 tab, 23 ref.

Descriptors: *Geology, *Alaska, *Geologic investigations, *Hydroelectric power, *Damsites, Engineering geology, Dam foundations, Tunnels, Rock properties, Rock mechanics.
Identifiers: Damsite geology (Baranof Island).

Proposed powersites are on the east side of Baranof Island, southeastern Alaska. One powersite is at Kasnyku Lake in the northern part of Baranof Island, 20 mi northeast of Sitka; the other is at Deer Lake in the southern part of Baranof Island, 48 mi south of Kasnyku Lake. The region is rugged, mountainous, and extremely glaciated and lies within the Chilkat-Baranof Mountains section of the Pacific Border Ranges province. Southern Baranof Island is underlain by metamorphic rocks of Triassic to Cretaceous age that are intruded by dioritic rocks. Northern Baranof Island is underlain by metamorphosed sedimentary rocks that range from probably Paleozoic to Cretaceous age. These rocks form 2 broad structural features, a northwest-trending anticlinorium flanked by a north-northwest-trending synclinorium. The northeast and northwest sides of northern Baranof Island are bound by northwest-trending lineaments that are probably traces of major faults. Many of the conspicuous linear features on Baranof Island are believed to be along prominent joint systems. No evidence of faulting was found at the powersites. The waterpower developments would be best accomplished by the construction of dams to raise the lake levels and by drawdown below normal lake level for maximum power capacity. (Knapp-USGS)
W69-09911

TRANSIENT STRESSES AND DISPLACEMENT AROUND A WELLBORE DUE TO FLUID FLOW IN TRANSVERSELY ISOTROPIC, POROUS MEDIA: 2, FINITE RESERVOIRS,
Texas Univ., Austin.
M. S. Seth, and K. E. Gray.
Trans Soc Petrol Eng, Amer Inst Mining, Met, and Petrol Eng, Inc, Vol 243, Part 2, p 79-86, 1968. 8 p, 11 fig, 5 ref.

Descriptors: *Stress analysis, *Porous media, *Fluid mechanics, *Water wells, *Groundwater movement, Mathematical studies, Aquifers, Thermal stress, Pressure, Rocks, Physical properties, Rock properties, Boreholes, Porosity.
Identifiers: Fluid flow in porous media.

The application of the equations of elasticity developed by Seth and Gray (1968) for infinite reservoirs are applied to the study of finite reservoirs. The following cases are investigated: (1) steady-state flow; (2) constant pressures at the borehole and outer boundary; and (3) constant pressure at the borehole and no flow at the outer boundary. Radial stresses are compressive or neutral, whereas tangential and vertical stresses may be tensile, neutral, or compressive, depending upon the boundary conditions, the physical properties of the system, and the radial distance involved. For constant boundary pressures, both radial and tangential stresses increase with time whereas they both decrease for a closed outer boundary and constant pressure at the borehole. For steady-state systems, radial displacement may be positive or negative depending upon the dimensions of the system, the pressure difference, and porosity. (Gabriel-USGS)
W69-09926

ROCK FAILURE DURING TOOTH IMPACT AND DYNAMIC FILTRATION,
Texas Univ., Austin.
G. M. Myers, and K. E. Gray.
Trans Soc Petrol Eng, Amer Inst Mining, Met, and Petrol Eng, Inc, Vol 243, Part 2, p 163-173, 1968. 11 p, 19 fig, 3 tab, 9 ref.

Descriptors: *Rock mechanics, *Drilling, *Rock properties, *Dynamics, *Filtration, Stress analysis, Saline water, Saturated flow, Geology, Sandstones, Pore pressure, Mud, Boreholes, Plasticity, Tensile pressure, Drilling equipment, Simulation analysis.
Identifiers: Borehole rock failure.

The effects of single-blow bit-tooth impacts on salt water-saturated Berea and Bandera sandstone samples were investigated under conditions of elevated confining and pore pressure. During the tests dynamic filtration and deposition of a mud cake were taking place due to the presence of drilling mud in the borehole and a borehole-to-formation pressure differential. The saturation of those sandstones with salt water tends to make them weaker than when saturated with nonreactive fluids. Plastic failure often occurs even when extremely high-fluid-loss muds are present in the borehole. Brittle failure of sandstones in mud-filled boreholes is found to be relatively rare. In general the withdrawal of the bit induces a tensile force of considerable magnitude. (Gabriel-USGS)
W69-09927

VELOCITY OF COMPRESSIONAL WAVES IN POROUS MEDIA AT PERMAFROST TEMPERATURES,
Chevron Research Co., La Habra, Calif.
For primary bibliographic entry see Field 02C.
W69-10138

8G. Materials

EVALUATION AND CONTROL OF CORROSION AND ENCRUSTATION IN TUBE WELLS OF THE INDUS PLAINS, WEST PAKISTAN,
Geological Survey, Washington, D.C.
Frank E. Clarke, and Ivan Barnes.
Geol Surv Water-Supply Pap 1608-L, p L1-L61, 1969. 61 p, 40 fig, 5 tab, 13 ref.

Descriptors: *Corrosion, *Well screens, *Casings, Corrosion control, Saline water, Saline soils, Drainage, Well filters, Saturated soils, Iron, Calcium, Sulfur bacteria, Carbonates, Iron bacteria.
Identifiers: *Pakistan, *Indus Plains, Well screen encrustation, Inert well casings.

Waterlogging and soil salinization problems in much of the Indus Plains of West Pakistan are being overcome in part by tube-well dewatering

and deep leaching of salinized soils. The groundwaters are anaerobic and some are supersaturated with calcium carbonate (calcite) and iron carbonate (siderite). These waters are moderately corrosive to steel. Sulfate-reducing bacteria catalyze corrosion. Corrosion is concentrated in the relatively active (anodic) saw slots of water-well filter pipes, where metal loss is least tolerable. Deposition of calcium carbonate, iron carbonate, and other minerals clog the filter pipes. In some places well capacities are seriously reduced in very short periods of time. There appears to be no practicable preventive treatment for corrosion and encrustation in these wells. Periodic rehabilitation by downhole blasting or other effective mechanical or chemical cleaning methods will prolong well life. The most promising approach to future well-field development is to use filter pipes of epoxy-resin-bonded fiber glass, stainless steel, or other inert material which minimizes both corrosion and corrosion-catalyzed encrustation. Fiberglass plastic pipe appears to be the most economically practicable, and already is being used with promising results. (Knapp-USGS)
W69-09910

IMPROVED SEALANTS FOR INFILTRATION CONTROL, The Develoment and Demonstration of Materials to Reduce or Eliminate Water Infiltration Into Sewage.
Federal Water Pollution Control Administration, Washington, D.C.
For primary bibliographic entry see Field 05G.
W69-10255

09. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

WATER RESOURCES RESEARCH INTERESTS IN THE SENIOR COLLEGES AND UNIVERSITIES OF NORTH CAROLINA.
North Carolina Univ., Chapel Hill. Water Resources Research Ints.
For primary bibliographic entry see Field 09C.
W69-10083

INVENTORY OF ACTIVE WATER RESOURCES RESEARCH PROJECTS IN NORTH CAROLINA.
North Carolina Univ., Chapel Hill. Water Resources Research Inst.

N C Univ Water Resources Res Inst Rep, July 1, 1969. 72 p. OWRR Proj No A-999-NC.

Descriptors: *Projects, *Research facilities, *Research and development, *Water resources development, *North Carolina, Reviews, Surveys, Data collections, Documentation, Laboratories, Universities.
Identifiers: *Water resources research.

An inventory of all water resources projects in North Carolina in 1969 is presented. Organizations conducting research include colleges and Universities, private industry, State agencies, and Federal agencies. Each project description includes title, location, work description, starting and completion dates, and names of researchers. (Knapp-USGS)
W69-10084

9C. Research Facilities

FOREST HYDROLOGY RESEARCH IN THE UNITED STATES,
Forest Service (USDA), Washington, D.C.
Clark E. Holscher.
Int Symp on Forest Hydrol, Penn State Univ, Aug 29-Sept 10, 1965. p 99-103, Pergamon Press, New York, 1066.
Descriptors: *Hydrologic aspects, *Watershed managment, *Forest management, *Water yield improvement, Rehabilitation, Rainfall-runoff relationships, Snow management, Vegetation effects, Flood protection, Soil stabilization, Evapotranspiration.
Identifiers: *Watershed protection, Soil improvement.

Forest influences has concerned foresters since 1893, although the first research began only in 1912 at Wagon Wheel Gap in Colorado. Since then, research in forest hydrology has spread countrywide; the Forest Service conducts most of it, but the universities have rapidly growing programs. Well over half the effort is still in applied research, oriented toward the solution of problems. Many facets of forest hydrology research are discussed. (Reigner-Forest Ser)
W69-10006

WATER RESOURCES RESEARCH INTERESTS IN THE SENIOR COLLEGES AND UNIVERSITIES OF NORTH CAROLINA.
North Carolina Univ., Chapel Hill. Water Resources Research Ints.

N C Univ Water Resources Res Inst Rep, July 1, 1969. 19 p. OWRR Proj No A-999-NC.

Descriptors: *Projects, *Research and development, *Water resources development, *North Carolina, Surveys, Data collections, Laboratories, Universities.
Identifiers: *Water resources research.

The water resources research interests of the staffs of the colleges and universities of North Carolina are listed. The information given is college or university name, school, department, researcher's name, and his fields of interest. (Knapp-USGS)
W69-10083

INVENTORY OF ACTIVE WATER RESOURCES RESEARCH PROJECTS IN NORTH CAROLINA.
North Carolina Univ., Chapel Hill. Water Resources Research Inst.
For primary bibliographic entry see Field 09A.
W69-10084

9D. Grants, Contracts, and Research Act Allotments

WATER RESOURCES RESEARCH CATALOG, VOLUME FOUR.
Smithsonian Institution, Washington, D.C. Science Information Exchange.
For primary bibliographic entry see Field 10.
W69-10115

ANNUAL REPORT, FISCAL YEAR 1969,
North Carolina Water Resources Research Inst., Raleigh.
David H. Howells.
WRRI-UNC Unnumbered Report, 1969. 46 p. OWRR Contract 14-01-0001-1853.

Descriptors: *Water resources research, Education.

The Water Resources Research Institute is North Carolina's water research center. A unit of the Consolidated University, located at North Carolina State University, it works closely with the North Carolina Department of Water and Air Resources and other agencies in the formulation of a research program responsive to State water resources problems. A twenty-five man Advisory Committee representative of State and Federal water agencies, industry agriculture, and local government provides guidance and review. The Institute's research program for fiscal year 1968-69 was supported by the annual allotment and eight matching grants from the Office of Water Resources Research, nonfederal matching and other funds from the Consolidated University of North Carolina and private industry, and two grants from the North Carolina Department of Water and Air Resources. Action by the North Carolina Legislature appropriating funds in partial support of the Institute during the next biennium greatly strengthened the federal-state cooperative relationship underlying this program and placed it on a firm foundation for the future. Report contains description of water resource problems and related research projects, summary of research findings, and discussion of program development, education, and public service programs.
W69-10295

10. SCIENTIFIC AND TECHNICAL INFORMATION

SELECTED URBAN STORM WATER RUNOFF ABSTRACTS.
Franklin Inst. Research Labs., Philadelphia, Pa. Science Information Services.
For primary bibliographic entry see Field 04C.
W69-10085

WATER RESOURCES RESEARCH CATALOG, VOLUME FOUR.
Smithsonian Institution, Washington, D.C. Science Information Exchange.

Dep of Interior, Office of Water Resources Res Sci Inform Center Rep, Vol 4, Dec 1968. 1315 p, 4 index. Available from Supt of Documents, Wash, DC, 20402, for $8.50 a copy, order as Catalog No I1.94:4.

Descriptors: *Research and development, *Projects, *Water resources development, *Contracts, Programs, Project planning, Project purposes, Federal government, Federal project policy.
Identifiers: *Water resources research catalog.

The Water Resources Research Catalog, vol 4 is a tabulation of descriptions of 4,501 research projects, most of which are funded by the U.S. Government. Some of the projects are independently funded and voluntarily reported. Each project description includes the name of the investigator, title of the project, object of study, plan of work, and source of support. The catalog lists 5,749 investigators, 781 performing organizations (194 of which are Federal), and 320 supporting organizations (31 of which are Federal). (Knapp-USGS)
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